Consultation Paper

Guidelines for the Rate of Return for Gas Transmission and Distribution Networks

21 December 2012

Economic Regulation Authority
WESTERN AUSTRALIA

A full copy of this document is available from the Economic Regulation Authority website at www.erawa.com.au. For further information, contact

Economic Regulation Authority
Perth, Western Australia
Phone: (08) 6557 7900

The copying of this document in whole or in part for non-commercial purposes is permitted provided that appropriate acknowledgement is made of the Economic Regulation Authority and the State of Western Australia. Any other copying of this document is not permitted without the express written consent of the Authority.

Disclaimer

This document has been compiled in good faith by the Economic Regulation Authority (the Authority). This document is not a substitute for legal or technical advice. No person or organisation should act on the basis of any matter contained in this document without obtaining appropriate professional advice.

The Authority and its staff members make no representation or warranty, expressed or implied, as to the accuracy, completeness, reasonableness or reliability of the information contained in this document, and accept no liability, jointly or severally, for any loss or expense of any nature whatsoever (including consequential loss) ("Loss") arising directly or indirectly from any making available of this document, or the inclusion in it or omission from it of any material, or anything done or not done in reliance on it, including in all cases, without limitation, Loss due in whole or part to the negligence of the Authority and its employees. This notice has effect subject to the *Trade Practices Act 1974* (Cth) and the *Fair Trading Act 1987 (WA)*, if applicable, and to the fullest extent permitted by law.

The summaries of the legislation, regulations or licence provisions in this document do not contain all material terms of those laws or obligations. No attempt has been made in the summaries, definitions or other material to exhaustively identify and describe the rights, obligations and liabilities of any person under those laws or licence provisions.

Contents

List of Tables **v**

1 Introduction **1**

1.1 The requirement 1

1.1.1 The ERA's approach to developing the RoR guidelines 2

1.1.2 Consultation on the RoR guidelines 3

2 Objective and other requirements **6**

2.1 The objective for the Rate of Return 6

2.1.1 Efficient financing costs 6

2.1.2 Benchmark efficient entity 8

2.1.3 Degree of risk associated with provision of reference services 9

2.1.4 Requirements for determining the efficient rate of return and its components 10

2.1.5 Criteria for exercise of discretion in determining the rate of return 12

3 Overall Regulatory Framework **15**

3.1 A nominal vanilla rate of return 15

3.1.1 Current practices 15

3.1.2 Discussion of Issues 16

3.1.3 Issues for Consideration 16

3.2 Components of the rate of return 17

4 Gearing **17**

4.1 Current Practices 17

4.2 Discussion of Issues 18

4.3 Issues for Consideration 19

5 Nominal Risk Free Rate **19**

5.1 Current Practices 19

5.2 Discussion of Issues 20

5.2.1 The choice of the proxy for "risk-free" assets 20

5.2.2 The term of the risk free rate 21

5.2.3 The averaging period 21

5.3 Issues for Consideration 22

6 The return on equity **22**

6.1 Models for estimating the return on equity 22

6.1.1 Current practices 23

6.1.2 Discussion of Issues 23

6.1.3 Issues for Consideration 24

6.2 Market Risk Premium 25

6.2.1 Current Practices 25

6.2.2 Discussion of Issues 26

6.2.3 Interrelationship between the risk-free rate and the MRP 27

6.2.4 Issues for Consideration 28

6.3 Equity Beta 28

6.3.1 Current Practices 29
6.3.2 Discussion of Issues 29
6.3.3 Issues for Consideration 30
7 The return on debt 30
7.1 Credit Rating 30
7.1.1 Current Practices 31
7.1.2 Discussion of Issues 31
7.1.3 Issues for Consideration 32
7.2 Debt Risk Premium 33
7.2.1 Current Practices 33
7.2.2 Discussion of Issues 34
7.2.3 Issues for Consideration 35
7.3 Debt Raising Costs 36
7.3.1 Current Practices 36
7.3.2 Discussion of Issues 36
7.3.3 Issues for Consideration 37
8 Gamma 37
8.1.1 Current Practices 38
8.1.2 Discussion of Issues 38
8.1.3 Issues for Consideration 40
Appendix A Models for estimating the return on equity 41
Appendix B Australian Utilities Classified by S&P's and Bloomberg 44
Appendix C Credit Rating of BBB/BBB+ in S&P's and Moody's 47
Appendix D The "NPV = 0" Principle 49

List of Tables

Table 1	Timeline for development of and consultation on RoR guidelines	4
Table 2	Timing of forthcoming ‘review submission dates’	5
Table 3	Studies on the Estimates of Gamma using Dividend Drop-off Methods	39

1 Introduction

1. Under the Australian Energy Market Commission's (**AEMC**) recent changes to the National Gas Rules (**NGR**), the Economic Regulation Authority (**ERA**) is required to produce Rate of Return (**RoR**) guidelines at least every three years.[1] The guidelines provide an opportunity to undertake a comprehensive review of approaches for determining the RoR on capital.

2. This Consultation Paper is the first step in the ERA's development of the RoR guidelines. The Paper sets out the ERA's:

   - understanding of the requirements for developing the RoR guidelines, and its broad approach to meeting those requirements;
   - proposed process and timeline for consulting with stakeholders on the development of the RoR guidelines; and
   - identification and preliminary assessment of the range of additional options to be evaluated in the review.

3. Submissions on any matter raised in this Consultation Paper may be in either written form or, preferably, electronic form. Submissions should be marked to the attention of Dr Duc Vo and addressed to:

   Rate of Return Guidelines Review
   Economic Regulation Authority
   PO Box 8469
   Perth BC WA 6849

   Email: publicsubmissions@erawa.com.au

   Submissions must be received by **4:00 pm (WST)** on **Thursday 28 February 2013**.

4. The ERA prefers that all submissions be in an electronic format and be made publicly available, so as to facilitate an informed, transparent and robust consultation process. Accordingly, submissions will be treated as public documents and posted on the ERA's website, www.erawa.com.au, unless prior arrangements are made with the ERA to treat the submission, or portions of it, as confidential.

5. For further information, please contact Dr Duc Vo on (08) 6557 7900 or email at duc.vo@erawa.com.au.

1.1 The requirement

6. The new rules require that the RoR guidelines set out the methodologies, estimation methods, financial models, market data and other evidence that the ERA proposes to take into account in estimating the return on equity, the return on debt and the value of imputation credits. These RoR methodologies will provide guidance for subsequent

[1] Australian Energy Market Commission 2012, *National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012 No. 3*, www.aemc.gov.au.

gas access decisions of the ERA, although they would not be binding. The ERA or service providers may depart from the guidelines in reviewing an access arrangement, provided that adequate explanation is provided at the time of the review.

7. The first RoR guidelines must be finalised and published by the ERA by 29 November 2013.

8. With regard to developing the RoR guidelines, the ERA is required to publish by 21 December 2012 a paper that sets out:[2]

   - a schedule detailing the key dates and milestones for the making of the first RoR guidelines; and
   - the specific consultation procedure that the ERA will follow in making the first RoR guidelines, which must be consistent with the RoR consultative procedure.

9. The RoR consultative procedure sets out that among other things:[3]

   - the ERA must publish – on a website and in a newspaper circulating generally throughout Australia – a notice that describes the proposed RoR guidelines review and the reasons for it, which invites written submissions within no less than 30 business days of the date of the notice; and
   - the ERA may publish issues, consultation and discussion papers, and hold conferences and information sessions as it considers appropriate in relation to the proposed RoR guidelines.

1.1.1 The ERA's approach to developing the RoR guidelines

10. The ERA's responsibilities under the National Gas Law and the NGR relate to approving third party access regimes in Western Australia for the Dampier to Bunbury Natural Gas Pipeline, the Goldfields Gas Pipeline and the Mid-West and South-West Gas Distribution System.

11. As noted, the development of the RoR guidelines provides an opportunity for the ERA to review its approach to setting the RoR for future decisions relating to these access arrangements. The ERA intends that this review will provide for a thorough assessment of its approach to determining the RoR on capital. The ERA will ensure that all stakeholders have every opportunity to provide input to its review.

12. The ERA in its review expects to maintain a focus on the overall methodologies for developing the RoR. This focus would be consistent with the requirements of the changes that have been set out in the revised NGR. To this end, the ERA expects to identify, consider and ultimately choose a preferred set of methods, models and data sets from among the broad range of possible alternatives.

13. The 'review submission dates' for the three gas networks regulated by the ERA are 18 months apart.[4] The length of this period, combined with the limited number of gas networks access arrangement reviews, has meant that the ERA has, in the past, been

[2] Australian Energy Market Commission 2012, *National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012 No. 3,* www.aemc.gov.au, clause 37.

[3] Australian Energy Market Commission 2012, *National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012 No. 3,* www.aemc.gov.au, clause 9B.

[4] The 'review submission date' means a date on or before which an access arrangement revision proposal is required to be submitted – from the National Gas Rules (Australian Energy Market Commission 2012, National Gas Rules, www.aemc.gov.au, Version 14, 49 to 52).

able to consider each review on a case by case basis. The ERA expects that this case by case approach will continue for the development of the parameter estimates.

14. The ERA therefore expects to set out indicative RoR parameter values as part of the process of developing the methodologies for the RoR guidelines. However, the specific parameter values arising from the application of the final RoR methodologies would be considered at each subsequent access arrangement review.

15. The starting point for the ERA will be its RoR assessments that are set out in its recent decisions relating to access to gas pipelines and networks in Western Australia. These current positions will be reviewed against the range of alternative approaches, with a view to arriving at an approach that ensures that the RoR objective is best met.

16. The ERA recognises the desirability of working towards RoR methodologies for Western Australian natural gas pipelines and networks that are as consistent as possible with approaches taken in other jurisdictions.[5] To this end, the ERA intends working closely with the Australian Energy Regulator (**AER**). Coordination with the AER is considered further below.

1.1.2 Consultation on the RoR guidelines

17. The ERA intends consulting stakeholders as part of the development of the proposed RoR guidelines. The consultation will be underpinned by the publication of this Consultation Paper, and by the subsequent Draft RoR guidelines. Both of these papers will give opportunities for stakeholders to make formal submissions to the ERA.

18. The ERA will also conduct workshops and other consultations as required. The need for such additional consultation will be determined on an as needed basis.

19. Consistent with the requirements of the amended rules, the ERA sets out its proposed timeline for consultation on the RoR guidelines as follows (Table 1).

20. The ERA recognises that the timeline for its RoR guidelines development process is different to the AER's timeline. Nevertheless, the ERA notes that the timeline provides significant opportunity for coordination with the AER – including through the conduct of joint processes such as workshops and research – both prior to and after the release of the RoR draft guidelines.

[5] The AEMC noted that (Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, www.aemc,gov.au, p. 23):

> There is a strong case for a common framework under the NER, including as between transmission and distribution, and NGR for setting the rate of return. A common framework can minimise any risks of distortions in capital allocation or investment decisions between the electricity and gas sectors, although the framework contemplated here would provide scope for the regulator to consider the different characteristics of NSPs in each sector when determining a rate of return for each NSP.

Table 1 Timeline for development of and consultation on RoR guidelines

Milestone	Date
Publication of the Consultation Paper	By 21 December 2012
Submissions on Consultation paper	End February 2013
Stakeholder workshops as required	April/May 2013
Draft RoR guidelines	June/July 2013
Submissions on Draft RoR guidelines	August/September 2013
Stakeholder workshops as required	September/October 2013
Final RoR guidelines	No later than 29 November 2013

21. The ERA considers that its consultation process:

- provides an early opportunity for stakeholders to present their views;
- takes account of the resources available to the ERA, maximising the likelihood that the ERA is able to release a Draft RoR guidelines in June or July 2013, and a final RoR guidelines by no later than 29 November 2013; and
- enhances the potential for the ERA to be in advance of its timeline with regard to the release of the final RoR guidelines.

22. The ERA will make a decision on the exact timing of the release of the Draft RoR guidelines and the Final RoR guidelines closer to the relevant time. With regard to the exact timing, the ERA will need to weigh up the benefits of completing the RoR guidelines early, with any resulting costs associated with reduced coordination with the AER.

1.1.2.1 Transitional issues

23. With regard to transitional issues, the AEMC has decided to allow ATCO Gas to delay its next 'review submission date' until three months after the release of the final RoR guidelines, and Goldfields Gas Transmission (**GGT**) to delay its review submission date by up to six months after the release of the final RoR guidelines (refer Table 2).[6]

[6] Australian Energy Market Commission 2012, *National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012 No. 3,* www.aemc.gov.au, Schedule 1, Part 5, clause 35.

Table 2 Timing of forthcoming 'review submission dates'

	Scheduled date	Potential latest date
ATCO Gas Network	1 July 2013	1 March 2014
Goldfields Gas Transmission	1 January 2014	1 July 2014
Dampier to Bunbury Natural Gas Pipeline	1 January 2015	-

24. Despite this, the ERA considers that it will be important to minimise any disruptions to the timing of its reviews, given the potential for any delays in its decisions to impose costs on consumers and shareholders.

25. In this context, the ERA recognises that the review submission date for the Dampier to Bunbury Natural Gas Pipeline (**DBNGP**) access arrangement is 1 January 2015, with revised arrangements to be implemented by 1 January 2016. Given that DBNGP shippers have the option of reverting to reference tariffs at that time, the ERA considers that it would be important to avoid any delays to the Final Decision for the DBNGP review.

26. The ERA is also mindful of its limited resources, and the consequent desirability of avoiding three concurrent access arrangement reviews.

27. Given these considerations, the ERA is of the view that it would be important to have concluded the reviews for ATCO Gas and GGT by 30 June 2015 at the very latest.

28. These factors point to the benefits of getting the RoR guidelines finalised as soon as possible, but importantly, no later than 29 November 2013.

1.1.2.2 Issues for Consideration

29. The ERA is seeking views and supporting information from interested parties on the following issues:

> 1. *Is it reasonable to focus on the overall RoR methodologies in developing the RoR guidelines, and not develop specific parameter values within the RoR guidelines?*

2 Objective and other requirements

30. The objective and other specific requirements of the new NGR will be used to assess the relative merits of alternative approaches to determining the RoR on capital. These are considered in what follows.

2.1 The objective for the Rate of Return

31. The determination of the allowable RoR on capital is to be informed by an explicit new RoR objective. The new RoR objective is set out at NGR 87(3):[7]

> 87(3) The *allowed rate of return objective* is that the rate of return for a service provider is to be commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services (the *allowed rate of return objective*).

32. The AEMC considers that the 'role of the RoR objective is to indicate what the regulator should be seeking to achieve in the exercise of its discretion' with regard to the RoR.[8] The AEMC considers that the RoR objective is closely linked to the National Gas Objective (**NGO**).[9]

33. The AEMC clarifies that:[10]

> ....it is not necessarily expected that the substance of the objective will always be fully achieved, but rather the regulator should be striving to achieve the objective as fully as possible. Where it is used in rate of return and capex incentives, the objective has primacy over other matters which the regulator is directed to consider.

34. The wording of the RoR objective requires that the RoR is to be based on:

- efficient financing costs; of
- a benchmark efficient entity; with
- a similar degree of risk as the service provider in respect of the provision of reference services.

2.1.1 Efficient financing costs

35. The requirement that the RoR be commensurate with 'efficient financing costs' refines the previous requirements in the NGR. While this component can be construed to have been implicit in the NGO's requirement for 'efficient investment' (see footnote 9), the new term makes the link explicit.

---

[7] Australian Energy Market Commission 2012, *National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012 No. 3,* www.aemc.gov.au, 87(3).

[8] Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, www.aemc,gov.au, p. 36.

[9] Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, www.aemc,gov.au, p. 38. The NGO states that (Government of South Australia 2008, *National Gas (South Australia) Act 2008*, www.legislation.sa.gov.au):

> **23-National gas objective**: The objective of this Law is to promote efficient investment in, and efficient operation and use of, natural gas services for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas.

[10] Ibid.

2.1.1.1 Current Practices

36. Efficient financing works to allocate capital to its most valued uses over time, at lowest cost. This efficient allocation draws on the available information on the returns to capital of each alternative allocation, and particularly on the available information on the associated risks.

37. Under the ERA's previous approaches, an efficient service provider was considered to finance its activities through a cost minimising mix of equity and debt. The concept of efficient financing costs therefore extends to a consideration of efficient allocation of both equity and debt, and what these imply for the rate of return.

38. The weighted average cost of capital (**WACC**) approach – adopted by the ERA and other regulators as a means to quantify the RoR – reflected these considerations. The WACC reflects the competitive RoR that an entity must earn on its existing asset base in order to satisfy its creditors, shareholders and other providers of capital.

2.1.1.2 Discussion of Issues

39. The AEMC's view is that efficient financing costs mean that the capital necessary to provide the service at the required standard is available, at minimum cost:[11]

> A rate of return that reflects efficient financing costs will allow a service provider to attract the necessary investment capital to maintain a reliable energy supply while minimising the cost to consumers.

40. The ERA considers that the AEMC's view is consistent with the current WACC-based approach. The new NGR specifically require the separate consideration of the return on debt and equity, with the RoR to be the weighted average of the two.[12]

41. However, the primacy of the overall RoR objective is emphasised by the AEMC. The regulator is required to be mindful that the separate consideration of the return on debt and on equity does not lead – in some overly mechanistic way – to a rate of return that is inconsistent with the benchmark cost of capital. With this in mind, the AEMC notes that consideration of the return on debt and equity must be jointly determined:[13]

> In determining the allowed rate of return, the regulator would be required to consider the return on equity and the return on debt as the allowed rate of return comprises a weighted average these two components. Although, for practical purposes, the regulator may turn its mind to separately estimating the return on equity and return on debt, the Commission considers that the process is a joint estimation exercise and that the regulator must ensure that the overall estimate of the rate of return satisfies the overall objective.

42. This 'joint estimation' has a number of implications.

43. First, it requires the regulator to consider the interaction between estimates of the cost of debt and of the cost of equity. This implies a need to identify the elements of that interaction, and to understand the implications of changes in one for the other. There

[11] Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, www.aemc,gov.au, p. 43.

[12] Australian Energy Market Commission 2012, *National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012 No. 3,* www.aemc.gov.au, 87(4).

[13] Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, www.aemc,gov.au, p. 67.

also are considerations of internal consistency with regard to the component inputs and assumptions.

44. Second, it raises questions about how the overall rate of return that is established through the WACC methodology might be cross-checked with actual market outcomes. In this context, there are a number of methodologies – such as the 'alternative' models for estimating the rate of return (see Appendix A) or the range of market evidence, including financial metrics – which might be used to inform the overall result.

45. Each of the elements in the WACC is considered in greater detail in subsequent sections on the cost of equity and the cost of debt.

2.1.1.3 Issues for Consideration

46. The ERA is seeking views and supporting information from interested parties on the following issues:

> 2. *What constitutes 'efficient financing costs', and how should this inform the approach to estimating the RoR?*
> 3. *What elements need to be considered 'jointly' under the WACC and what does this mean in practice?*
> 4. *Are there other methods which provide information on efficient financing costs, which need to be taken into account?*

2.1.2 Benchmark efficient entity

47. The requirement that the RoR reflect that of a benchmark efficient entity implies that it is assumed that the service provider has structured its finances in order to minimise its cost of capital, in a way that is consistent with best practice for the industry. This assumption reflects the underlying objectives for incentive regulation, and seeks to ensure that customers do not bear the costs of inefficient decisions by service providers.

48. In practical terms, the requirement establishes a need to quantify the key characteristics of the benchmark efficient entity. Generally, the process to quantify these benchmark characteristics involves establishing a conceptual definition for the benchmark efficient entity, and then gathering evidence from actual 'comparator' entities which resemble the conceptual entity.

2.1.2.1 Current practices

49. All Australian regulators have used benchmark approaches, for example when estimating the gearing ratio and the credit rating.

50. For the gearing ratio, the ERA has accepted proposals in its recent gas access arrangement decisions that are consistent with the benchmark entity methodology. The methodology – which generally has led to the adoption of a 60:40 debt equity ratio

for energy utilities – is based around an average book value of gearing for a sample of Australian energy utilities.[14]

51. The ERA adopted a BBB+ benchmark for the credit rating for its recent gas access arrangement decisions, based on a benchmark sampling approach. In adopting the benchmark, the ERA also took account of the precedent for BBB+ from previous regulatory decisions in Australia, noting that the AER retained a BBB+ benchmark in its 2009 WACC review for electricity.

2.1.2.2 Discussion of Issues

52. Information for benchmarking may not always be obtainable for particular business segments, such as the gas pipeline or network industry, or may be subject to sampling issues. Consideration therefore needs to be given to whether the benchmarks should be based on some wider or proxy industry benchmark, some more theoretical construct, or some combination of approaches.

53. Benchmarking measures tend to be based on an average or median of an observed industry sample. However, consideration could be given to providing greater incentives for achievable reductions in financing costs. Such an approach would imply that the estimate for the benchmark efficient service provider should be closer to the frontier of best practice.

54. More broadly, there is the question of whether benchmarking information may be derived only from domestic Australian data, or whether a broader, international set of data is relevant and acceptable.

55. A further important issue is whether consistency considerations require the exact same benchmark to be used for each parameter.

2.1.2.3 Issues for Consideration

56. The ERA is seeking views and supporting information from interested parties on the following issues:

> *5. What elements of the evaluation of the rate of return should be informed by benchmarking?*
>
> *6. What considerations are relevant when estimating the associated parameters for the benchmark efficient service provider?*

2.1.3 Degree of risk associated with provision of reference services

57. As noted above, the perceived degree of risk associated with the service provider in providing reference services is a key element in the pricing of capital. The degree of risk is generally taken to be associated with the industry, rather than the individual

[14] Australian Energy Regulator 2009, *Final Decision: Electricity transmission and distribution network service providers: Review of weighted average cost of capital (WACC) parameters*, www.aer.gov.au, May, p. 113.

service provider, and therefore is closely related to the concept of the benchmark efficient service provider.

2.1.3.1 Current practices

58. The ERA assesses capital risks based on market observations provided by a set of Australian energy utilities. The use of Australian data is consistent with the adoption of a domestic CAPM framework.

59. For equity, this is reflected in the beta associated with the observed sample of energy utilities.

60. For debt, the risk is assessed from the debt margin of the observed sample.

2.1.3.2 Discussion of Issues

61. As with the assessment of benchmarks, a key question relates to whether information may be derived only from domestic Australian experience, or whether a broader, international set of data is relevant and acceptable. A further question relates to whether benchmarking should be based on only similarly regulated utilities, given that there is evidence to suggest that the beta for regulated entities is lower than that of entities that are not regulated.[15]

62. There are also potential new issues relating to risk. For example, the impact of carbon pricing and other rapid changes in the energy industry may be increasing the volatility of demand, which in turn may influence the risk associated with the industry. More recently, the global financial crisis has seen a flight from risky assets, and a re-rating of capital risks more generally.

2.1.3.3 Issues for Consideration

63. The ERA is seeking views and supporting information from interested parties on the following issues:

> 7. *How may the degree of risk for a benchmark service provider be measured? What does this imply for the estimation methods, models, data sets and other information required to determine the RoR?*
>
> 8. *Does a current estimate of the degree of risk of a service provider provide a reasonable proxy for risk over the course of a future access arrangement? Should any expected new risks be accounted for? What are the implications for the return on equity and debt?*

2.1.4 Requirements for determining the efficient rate of return and its components

64. The ERA has in the past determined a RoR informed by the requirements of the previous NGR. These requirements were reasonably broad, referring to 'prevailing conditions in the market for funds and risks involved in providing reference services',

[15] Blake M.S. and Fallon J. 2012, The Form of Regulation and Non-diversifiable Risk, *Network*, Issue 44, June, www.accc.gov.au, p. 1.

'benchmark standards as to gearing' and other financial parameters, and to the use of a 'well accepted approach... such as the weighted average cost of capital ... and the Capital Asset Pricing Model'.[16]

65. In addition to meeting the RoR objective, the new NGR 87 sets out a number of additional requirements for the RoR methodologies, including that the allowed rate of return, among other things:

- achieves the allowed rate of return objective (new NGR 87(2));
- subject to the rate of return objective (new NGR 87(2)), the allowed rate of return is to be:
  - a weighted average of the return on equity and the return on debt (new NGR 87(4)(a));
  - a nominal vanilla rate of return that is consistent with the estimate of the value of imputation credits (new NGR 87(4)(b));[17]
- is informed by relevant estimation methods, financial models, market data and other evidence (new NGR 87(5)(a));
- involves consistent application of any estimates of financial parameters, that are common to the return on equity and on debt (new NGR 87(5)(b));
- accounts for inter-relationships between estimates of financial parameters (new NGR 87(5)(c));
- incorporates a return on equity that reflects prevailing market conditions (new NGR 87(7));
- results in a return on debt which is either the same in each year of the access arrangement period or which varies in each year through the application of an automatic formula (new NGR 87(9) and NGR 87(12));
- incorporates a return on debt that would be required by debt investors over a relevant time period (whether shortly before the access arrangement decision, or on average over an historical period, or some combination of the two approaches) (new NGR 87(10));
- incorporates a return on debt that has regard for the following factors:
  - the desirability of minimising any differences between the return on debt and the return on debt of a benchmark efficient entity (new NGR 87(11)(a));
  - the interrelationship between the return on equity and the return on debt (new NGR 87(11)(b));
  - the incentives that the return on debt may provide in relation to capital expenditure and its timing over the access arrangement (new NGR 87(11)(c)); and
  - accounts for any impacts on a benchmark efficient entity that could arise as a result of changing the methodology that is used to estimate the return on debt from one access arrangement period to the next (proposed NGR 87(11)(d)).

[16] Australian Energy Market Commission 2012, *National Gas Rules*, www.aemc.gov.au, version 13, clause 87, p. 58.

[17] The specification of a vanilla WACC implies that tax liabilities must be estimated separately to the RoR. On this basis, the requirement is for a 'post-tax' approach.

66. The extent to which particular estimation methods, financial models, market data and other evidence meet these requirements will inform the ERA's ultimate choice of approach.

2.1.5 Criteria for exercise of discretion in determining the rate of return

67. It is feasible that sets of alternative methodologies, estimation methods, financial models, market data and other evidence may meet some, but not all, of the specific requirements of the new NGR 87 set out above. The ERA would therefore need to consider which one of a number of alternative approaches *best* meets the rate of return objective. In this context, the AEMC has stated:[18]

> The role of the objective is to indicate what the regulator should be *seeking* to achieve in the exercise of its discretion. Some stakeholders appear to have understood the objectives as imposing on the regulator a requirement and that failure to comply with this would mean the regulator is in breach of the rules. This is not the case. Although the language of an obligation is used in some objectives, it is not necessarily expected that the substance of the objective will always be fully achieved, but rather the regulator should be striving to achieve the objective as fully as possible. Where it is used in rate of return and capex incentives, the objective has primacy over other matters which the regulator is directed to consider.

68. The RoR objective may be *best* met if the RoR methodologies that are ultimately adopted, among other things, satisfy certain criteria. These criteria would provide a framework for the exercise of the ERA's regulatory discretion in accepting or rejecting a proposal, and would allow it to inform its reasoning in a structured manner. A good criterion is one which is:

- independent – clear and unambiguous in highlighting a principle on which regulatory judgment might hinge;
- objective – demonstrated by concrete evidence – whether quantitative or qualitative – rather than open to subjective interpretation;
- concise – simple and readily understandable; and
- relevant – incisive, able to expose differences in outcomes.

69. With this in mind, the ERA considers that, in making its regulatory judgments against the RoR objective and requirements set out above, it will need to take the following separate principles into account when determining the RoR parameters. The methodologies should:

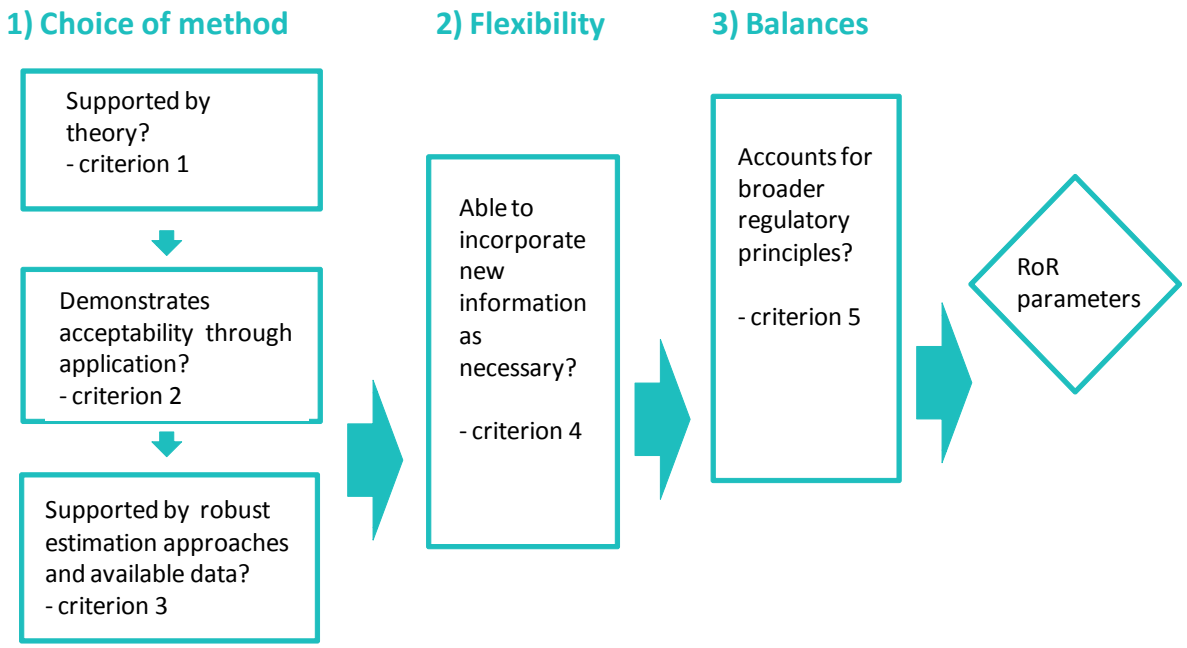
- be supported by theory – as this underpins good regulatory practice;
- have broad acceptability – as this informs the credibility and extent of application in practice;
- be based on robust, transparent estimation approaches, input data and other required information – as the availability of appropriate data and other inputs, internal consistency, and the robustness and replicability of the ensuing results are an important consideration in accepting any approach;
- be able to take account of new information – as an approach may need to be able to respond to changing market conditions and new evidence, and should do so in a robust manner; and

[18] Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, www.aemc,gov.au, p. 36.

- reflect broader balancing considerations – as broader regulatory principles may need to be taken into account, which may need to condition the choices supported by the other criteria.

70. These considerations can be organised in terms of the following 'decision' flow chart (Figure 1).

Figure 1 Elements informing regulatory discretion



71. A possible set of criteria informing each principle is summarised in Box 1 below. The number of each criterion is allocated to each element as per Figure 1.

BOX 1 Criteria for assessing rate of return methodologies

The RoR objective may be best met if the proposed RoR methodologies:

1) have a strong theoretical underpinning;
   - o recognise that the RoR methodologies ideally should be supported by theory;
2) are well-accepted;
   - o acknowledge that approaches which have widespread application and acceptability are more likely to enhance the credibility and acceptability of a decision;
3) are supported by robust, transparent and replicable analysis that is internally consistent and is derived from available, current and credible datasets;
   - o are derived from analysis and estimation methods that are transparent and replicable;
   - o are derived from analysis and estimation methods that are internally consistent;
   - o lead to outcomes from quantitative modelling that are sufficiently robust as to not be sensitive to small changes in the data;
   - o recognise that while some approaches may be sound, there may be insufficient data to allow their use, or the available data may be out of date;
   - o recognise that arbitrary filtering of data, or adjustment to the data, is undesirable;
4) have the flexibility to reflect changing market conditions and new information as appropriate;
   - o recognise the need to deal with uncertainty;
   - o give confidence that the RoR will reflect actual conditions prevailing in the market over the access arrangement period;
5) lead to consistent regulatory decisions across industries, service providers and time;
   - o recognise the desirability of a common approach to regulation, so as to avoid distortions in investment decisions.

2.1.5.1 Issues for Consideration

72. The ERA is seeking views and supporting information from interested parties on the following issues:

> *9. Is it reasonable to consider criteria when evaluating alternative RoR methodologies?*
>
> *10. Is the decision framework identified robust? Are the criteria identified consistent with the RoR objective and requirements? Are there other criteria that might be considered?*
>
> *11. What other means might be used to evaluate alternative RoR methodologies to ensure that the RoR objective is best met?*

3 Overall Regulatory Framework

73. In establishing a framework for determining the RoR, the ERA will need to consider:

- a nominal vanilla approach to determining the rate of return;
- the components of the rate of return.

3.1 A nominal vanilla rate of return

74. The ERA is required to adopt a nominal vanilla approach to developing the RoR, in accordance with the new NGR 87(4) and NGR 87A, albeit 'subject to' the requirements of the overall RoR objective at NGR 87(2).[19]

75. A vanilla WACC would be independent of any influence of tax, including the tax effect on returns of imputation credits and the interest deductibility of debt. That is, the impact of tax on the returns to a business would need to be accounted for separately, as an explicit deduction from the relevant cash flows. A vanilla WACC is therefore a 'post-tax' framework.

3.1.1 Current practices

76. The ERA has applied a pre-tax real estimate of the RoR in its recent decisions on access arrangements for the Dampier to Bunbury Natural Gas Pipeline and the Mid-West and South-West Gas Distribution System. The ERA also accepted a proposal to apply a pre-tax nominal estimate of the RoR by Goldfields Gas Transmission for the Goldfields Gas Pipeline.

77. More recently, the ERA has applied a 'hybrid real' post tax approach in its electricity networks determination on Western Power's third access arrangement period for 2012/13 to 2016/17.[20]

[19] Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, www.aemc.gov.au, p. 50.

[20] Economic Regulation Authority 2012, *Further Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network*, www.erawa.gov.au, November.

78. The ERA recognises that these approaches are generally not consistent with the requirements under the new NGR 87.

79. The AER has applied a nominal vanilla RoR to its decisions for gas access arrangements.

3.1.2 Discussion of Issues

80. The AER's use of a nominal vanilla RoR is well established. The ERA could adopt the AER's post tax revenue model as an off-the-shelf solution to implementing the new requirements under the NGR.

81. However, the change from the previous pre-tax approach will raise transitional issues. The AEMC commented:[21]

> It is not the Commission's intention that gas service providers, or indeed consumers, face any unnecessary costs resulting from any transition from a real pre-tax approach. To the extent possible, the Commission would expect the impact on the limited number of gas service providers and their consumers from the change in approach to be neutral.
>
> ... As discussed in section 6.4.3, the final rule provides sufficient flexibility for the regulator to consider potential transitional issues either through the guidelines, or at the time of individual access arrangement reviews.

82. The ERA agrees in principle that there should not be any unnecessary costs to service providers or consumers resulting from the transition to the required nominal vanilla RoR regime, and that the concept of neutrality would be consistent with the overall objectives. That said, the ERA considers that generally these issues are not directly relevant to the estimation of the RoR itself, but rather relate to other components of the revenue model. For example, there are significant transitional issues relating to how assets are depreciated for regulatory and tax purposes. The ERA considers that these matters are outside of the scope of these RoR guidelines.[22]

3.1.3 Issues for Consideration

83. The ERA is seeking views and supporting information from interested parties on the following issues:

> *12. Are there any significant transitional issues associated with adopting the nominal vanilla WACC? Do these matters concern the RoR itself, or are they related to other aspects of the revenue model?*
>
> *13. Would there be any issues with the ERA adopting AER's current nominal post tax revenue model?*

[21] Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, www.aemc.gov.au, p. 62.

[22] For example, the ERA's recent Further Final Decision on Western Power's third access arrangement period accepted the service provider's proposal for a written down historic cost tax asset base for determining tax depreciation. This ensured that there was no 'claw back' of any revenue providing for tax liabilities that was associated with the previous real pre-tax approach (Economic Regulation Authority 2012, *Further Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network*, www.erawa.com.au.).

3.2 Components of the rate of return

84. The new NGR specify that the RoR should be a weighted average of the cost of equity and cost of debt (new NGR 87(4)(a)).

85. The resulting weighted average cost of capital (**WACC**) for a benchmark efficient entity represents the competitive RoR that an entity must earn on its existing asset base in order to satisfy its creditors, shareholders and other providers of capital. In its simplest 'vanilla' form, the WACC may be expressed as:

$$WACC_{vanilla} = E(r_e) \times \frac{E}{V} + E(r_d) \times \frac{D}{V}$$

where

$E(r_e)$ = the expected return on equity

$E(r_d)$ = the expected return on debt

$\frac{E}{V}$ = the proportion of equity in total financing (which comprises equity and debt)

$\frac{D}{V}$ = the proportion of debt in total financing (which comprises equity and debt)

4 Gearing

86. Gearing refers to the proportions of the total asset value of the regulated business assumed to be financed by debt and equity. Financial gearing generally refers to the ratio of debt to total asset value, which comprises debt and equity. The relative proportions of debt and equity that a firm has outstanding constitute its capital structure. Choices of capital structure differ across industries, as well as for different companies within the same industry.

87. An optimal debt-equity ratio would maximise firm value, such that the overall cost of capital is at its minimum. However, the actual optimal value of debt and equity for any given firm is likely to be dynamic and dependent on a number of business specific factors. In practice, it is expected that in the long run firms move towards this optimal level of gearing.

88. In addition, gearing is also used in un-levering/levering between the (unlevered) asset beta and the (levered) equity beta. This process allows for the equity beta to be determined on a basis that is consistent with the assumed gearing of the benchmark efficient service provider. The gearing ratio is also considered as a factor to determine the credit rating of a regulated business for the purpose of determining the debt risk premium.

4.1 Current Practices

89. The benchmark gearing ratio is considered to reflect the assumed capital structure of a benchmark efficient utility business. As the optimal level of gearing is not directly

observable, the gearing level is derived from the average of actual gearing levels from a group of comparable firms.[23] In practice, these representative samples of regulated business have indicated an average benchmark gearing level of 60/40 debt to equity. The actual proportion of debt and equity for each business is dynamic and depends on business specific factors.

90. In consequence, for gas transmission and distribution, a gearing of 60/40 debt to equity has been adopted by Australian economic regulators to date. The AER assessed Bloomberg market and Standard and Poor's Industry Report card data for utility businesses from 2002 to 2007. Calculations from the Allen Consulting Group based on Bloomberg data were also considered. This produced a range of values between 57.8 and 65.1 per cent. The AER considered raising gearing from the previous level of 60 per cent, however, it did not consider that the change was significant enough to be justified, given the market conditions prevailing in 2009.[24]

91. In New Zealand, the New Zealand Commerce Commission (**NZCC**) has adopted a gearing ratio of 44 per cent. This gearing level is determined based on a sample of comparator companies.[25] This was deemed to be the service wide notional leverage calculated as the mean of a sample of comparator companies. Firms in the sample included electricity distribution and gas pipeline businesses from Australia, UK and the US.

92. The UK regulator Office of the Gas and Electricity Markets (**Ofgem**) has not yet set out a detailed methodology for setting notional gearing. They have highlighted that the issues that are at play when setting notional gearing are cash flow volatility, the companies' business plans and the cost of equity.[26] In the past they have determined notional gearing levels by selecting values that result in achieving financeability parameters and return on regulated equity ranges within their targets. Gearing levels for regulated entities and for other determinations are used as a crosscheck for consistency.[27]

4.2 Discussion of Issues

93. Key considerations relating to the relevant data and information required to determine the benchmark gearing level for regulated businesses include:

- the companies to be included in the benchmark sample (including whether these are only domestic companies or include international samples);
- the period in which gearing for these companies are observed;
- the methodology that is adopted to determine the "average" gearing from the sample; and

[23] Australian Energy Regulator, May 2009, *Final Decision, Electricity transmission and distribution network service providers, Review of the weighted average cost of capital (WACC) parameters, pp.111-127.*

[24] Australian Energy Regulator, May 2009, *Final Decision, Electricity transmission and distribution network service providers, Review of the weighted average cost of capital (WACC) parameters,* p.125.

[25] Commerce Commission New Zealand, December 2012, Reasons Paper: *Input Methodologies (Electricity Distribution and Gas Pipeline Services)*, pp.162-165.

[26] Ofgem, March 2011, *Decision on Strategy for the Next Transmission and Gas Distribution Price Controls - RIIO-T1 and GD1 Financial Issues*, p. 17.

[27] Ofgem, July 2012, *Initial Proposals for National Grid Electricity Transmission plc and National Grid Gas plc – RIIO-T1*, p. 18.

- the data sources.

94. Based on data set out in Appendix B, it appears that the classification of Australian utilities differs between Standard & Poor's and Bloomberg (this issue is discussed in greater detail at section 7.1).

4.3 Issues for Consideration

95. The ERA is seeking views and supporting information from interested parties on the following issues:

14. What criteria could be used to select an appropriate methodology for deriving the gearing level?

15. What are the key characteristics or the selection criteria for companies to be included in the benchmark sample?

16. What are the appropriate time periods and the methodology for determining the benchmark gearing ratio from available market data?

17. Would a methodology other than the benchmarking approach for assessing gearing better meet the NGR RoR objective and requirements?

5 Nominal Risk Free Rate

96. The nominal risk free rate is a key input to both the return on equity and the return on debt.

97. The risk free rate is the RoR an investor receives from holding an asset with a guaranteed payment stream (that is, that has no risk of default). Since there is no default on the risk-free assets, the return on risk-free assets compensates investors for time value of money, while minimising liquidity risk. It may also include compensation for certain other risks, such as inflation risk.

5.1 Current Practices

98. There are three key components in the estimate of the nominal risk-free rate of return by Australian economic regulators. These relate to (i) the choice of the proxy for "risk-free" assets; (ii) the term to maturity; and (iii) the averaging period.

99. First, Commonwealth Government Securities (**CGS**) are generally widely used by regulators as a proxy for the risk free rate in Australia.

100. Second, different terms to maturity of the risk free rate have been adopted by regulators. Some regulators use CGS with a 10-year term to maturity whereas others use CGS with a 5-year term to maturity.

101. The Australian Energy Regulator (**AER**), for example, has adopted a 10-year term for a nominal risk free rate.[28] The ERA and other regulators – including the Queensland Competition Authority (**QCA**) and the Independent Pricing and Regulatory Tribunal (**IPART**) – have adopted a 5-year term for the risk free rate. This reflects a view that the 5-year term better reflects economic principles, known as the "NPV = 0" principle. The "NPV = 0" principle requires that – in a regulated environment in which output prices are set or capped – the present value of the revenue earned from an asset must be equal to the initial investment to ensure that the total costs incurred are recovered. In addition, the 5-year term reflects the current practice of aligning the term of the risk free rate with the regulatory period (which is typically 5 years).

102. Third, current practices by Australian regulators generally involve an averaging[29] period of 20 trading days (or a period of between 10 and 40 days for the AER) as being the best proxy for a forward looking risk free rate. The ERA's recent empirical work, using Australian historical data, has confirmed that this observation holds.[30] Further details on this empirical work are discussed below.

103. The Alberta Utilities Commission (**AUC**) has traditionally used the Consensus Economics forecast for a 10-year Government of Canada bonds in order to estimate the value of the risk free rate.[31]

104. The NZCC considers that terms for the risk free rate could be 3, 4, or 5 years, depending on the length of the regulatory control period. NZCC used Bloomberg data on New Zealand Government bonds with corresponding terms to maturity.[32]

105. The risk free rate of return is annually updated by the NZCC for some particular regulated businesses. This practice of updating the risk free rate is also applied in the rail access regime in Western Australia, albeit under a different framework.

106. UK regulators including Ofgem and the Water Services Regulation Authority (**Ofwat**) have adopted a range with the lower bound matching the 10 year average yields on 10-year Index Linked Gilts and the upper bound with reference to regulatory precedent.

5.2 Discussion of Issues

107. Each of the above three key issues relating to the estimate of the nominal risk free rate is discussed in what follows.

5.2.1 The choice of the proxy for "risk-free" assets

108. Australian regulators have consistently adopted the observed yield to maturity of the CGS as the best proxy for the nominal risk-free rate of return.[33] The bonds issued by

[28] Australian Energy Regulator, May 2009, Final Decision, Electricity transmission and distribution network service providers, Review of the weighted average cost of capital (WACC) parameters, p. 168.

[29] There are three different types of moving averages: (i) Simple Moving Average; (ii) Exponential Moving Average; and (iii) Weighted Moving Average, and they are all calculated slightly differently. However, all have a similar smoothing effect on the data, so that any unexpected changes on rates are removed, and, as a result, the overall direction is shown more clearly. For simplicity, the ERA adopts the simple moving average in its calculations.

[30] Economic Regulation Authority, September 2012, Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network, pp. 659-666.

[31] Alberta Utilities Commission, December 2011, 2011 Generic Cost of Capital, Decision 2011-474, p. 9.

[32] Commerce Commission New Zealand, September 2012, Cost of Capital Determination for Electricity Distribution Businesses to Apply to a Customised Price-Quality Path Proposal, 2012 NZCC 25, p. 6.

the Commonwealth Government of Australia have been considered as the best proxy for the nominal risk free rate in Australia on the following grounds:

- First, the CGS are essentially free from default risk. The Australian Government has consistently received the highest possible credit ratings from both Standard and Poor's (**S&P's**) and Moody's. Payments from these bonds are guaranteed by the Australian Government.
- Second, these bonds are the most liquid assets in Australia in terms of the volume at issuance; various terms to maturity; and narrow spreads between bid-ask yields.
- Third, the observed yields of these bonds are transparently recorded and reported by the Reserve Bank of Australia on a daily basis and are publicly available.

5.2.2 The term of the risk free rate

109. In most circumstances, the yield curve, which represents the relationship between the observed yields and terms to maturity, is assumed to be upward sloping. As such, the risk free rate observed from a security with a 5-year term to maturity is generally lower than the risk free rate obtained from a security with a 10-year term to maturity.

110. The ERA adopted a term for the risk free rate of 5 years in the Final Decision on the Dampier to Bunbury Natural Gas Pipeline Access Arrangement in 2011.[34] This decision is based on the following three pieces of evidence:

- The "NPV = 0" principle from academic studies and consultant reports. An explanation of the principle is set out in Appendix E.
- The debt profiles for Australian rated utilities presented by S&P's in their industry report cards.
- The current debt profile of Australian utilities.

5.2.3 The averaging period

111. Australian economic regulators have to date adopted an averaging period of 10-40 trading days just prior to the release of the regulatory decisions.

112. The ERA has conducted its own analysis and concluded that a 20-trading day average just prior to the release of the regulatory decisions is the best proxy for the forward looking estimate of the risk free rate for the subsequent regulatory period of 5 years.[35]

5.2.3.1 The ERA's current view

113. In recent ERA's decisions, the yield on the CGS is considered to be a good proxy for a nominal risk free rate of return. A five year term for the risk free rate was adopted and

[33] See Blanco, Brennan, and Marsh 2005, "An Empirical Analysis of the Dynamic Relation between Investment-Grade Bonds and Credit Default Swaps", *The Journal Of Finance*, Vol. LX, no. 5 October, p2261, for details.

[34] Economic Regulation Authority, October 2011, *Final Decision on Proposed Revisions to the Access Arrangement for the Dampier to Bunbury Natural Gas Pipeline*, p.186.

[35] Economic Regulation Authority, September 2012, Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network, pp. 659-666.

the averaging period of 20 trading days was considered as the best proxy for the next five years.

5.3 Issues for Consideration

114. The ERA is seeking views and supporting information from interested parties on the following issues:

18. What criteria should be used to determine an appropriate method/model to estimate the nominal risk free rate of return?

19. What is the best proxy for the nominal risk free rate of return in the context of the Australian regulatory environment?

20. Are there any viable alternatives to the Commonwealth Government Securities as an appropriate proxy for the nominal risk free rate of return in Australia?

21. Should the long-term average or the prevailing risk free rate be used as a proxy for a forward looking estimate of the next five years?

22. Is there a proxy for the risk free rate, other than the 5 year CGS estimated over the 20 to 40 days just prior to the commencement of the regulatory period, which would better meet the new NGR RoR objective and requirements?

6 The return on equity

115. The tool commonly used for quantifying the return on equity and associated risk has been the Capital Asset Pricing Model (**CAPM**). The CAPM explains the expected return on equity for any financial asset in terms of its specific risk premium, over and above the nominal risk free rate.

116. The CAPM estimates the risk premium associated with a particular asset by quantifying the relationship between the specific asset and the level of systematic (or non-diversifiable) risk.[36] The higher the level of non-diversifiable risk of the asset, the higher is the required or expected rate of return. The CAPM uses the asset beta to describe the non-diversifiable returns of a particular asset.

117. There is also a range of other models which provide estimates for the return on equity.

118. In what follows, we consider these models for the return on equity, as well as the approaches for estimating an equity beta and the market risk premium.

6.1 Models for estimating the return on equity

119. The standard regulatory implementation of the CAPM is labelled the Sharpe-Lintner CAPM, after two of the original authors. There is also a range of other asset pricing

[36] The systematic risk or non-diversifiable risk encompasses those risks faced by market as a whole, which cannot be reduced by diversification through a well constructed portfolio of assets. This is the market risk premium.

models which provide estimates of the return on equity, some of which build on the standard CAPM.

120. In addition to the Sharpe-Lintner CAPM, other asset pricing models have been submitted to the ERA in recent regulatory processes, including:

- the Black CAPM;
- the Fama-French Three-Factor Model (**FFM**);
- the Zero-beta Fama French model; and
- the discounted cash flow model.

121. A summary of these alternative asset pricing models for estimating the return on equity is set out in Appendix A.

6.1.1 Current practices

122. The ERA and other regulators in Australia have used the Sharpe-Lintner CAPM exclusively for estimating the return on equity. The previous NGR specifically referred to this variant of the model as being an example of a 'well accepted' financial model.

123. The other versions of the CAPM have not been adopted in Australia given concerns about the theoretical background of the models and the robustness of inputs that are used in the models.

124. UK and New Zealand regulators, such as Ofgem, the NZCC, have also adopted the Sharpe-Lintner CAPM to estimate the return on equity. The Alberta Utilities Commission also uses the Sharpe-Lintner CAPM, but with scope for qualitative adjustments informed by evidence from other models.

6.1.2 Discussion of Issues

125. The ERA is required to consider alternatives to the Sharpe-Lintner CAPM for its approach to estimating the return on equity.

126. A threshold question arises then as to whether a single model or a weighted average of methods and models should be used to inform the RoR. In this context, the AEMC noted in its final decision that formulaic approaches may not be the best way to deal with information from multiple models:[37]

> In many circumstances it could be the case that the likelihood of achieving the NEO or the NGO may be increased by examining a range of methods and data and making judgements aided by, for example, the location and/or clustering and/or statistical precision of estimates. That is, formulaic rules such as giving particular methods a fixed weighting may not be the best way to assess the information.

127. The ultimate choice of approach will need to be informed by the NGR RoR objective and requirements. The ERA would expect to apply criteria reflecting its regulatory principles in making that choice, as set out in Section 2.1.5.

128. In this context, reliable and unbiased estimates of the inputs are crucial to the output of the models. Estimating the return on equity using the Sharpe-Lintner CAPM requires

[37] Australian Energy Market Commission 2012, *Rule Determination: National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012*, www.aemc.gov.au, p. 57.

the estimates of three different parameter inputs: (i) the nominal risk-free rate of return; (ii) the market risk premium; and (iii) an equity beta.[38]

129. There are many studies of the three inputs used in the Sharpe-Lintner CAPM, including within Australia. As a result, there is a good understanding of the factors driving the outcomes of the model.

130. In contrast, estimates of the input parameters used in the other models (that is, other than the Sharpe-Lintner CAPM) are much less common, at least for Australia. The resulting estimates for the return on equity appear to be volatile, depending on the method employed and research period. Estimates of the inputs have varied substantially, despite being from the same authors within a relatively short period of time.[39]

131. The use of Australian data reflects a choice by regulators for a domestic form of CAPM. However, as noted by the AER:[40]

> ...one of the key areas of debate in the Australian regulatory literature is the extent to which foreign investors should be recognised in the Australian domestic capital market. The choice of whether to adopt a domestic CAPM or an international CAPM is likely to influence the estimation of the... WACC parameters.

132. Having considered this issue, the AER ultimately retained the domestic form of the CAPM in its 2009 WACC decision, arguing that it was appropriate and reasonable given past regulatory practice and the reality of cross-border capital flows.[41]

133. Alternatives for estimating the return on equity (which also are detailed in Appendix A) include:

- the discounted cash flow model;
- estimated market returns on comparable businesses;
- price to book ratios.

134. Given the substantial debate on the estimates of the returns on equity for Australian regulated businesses, these other models may be considered as candidates for cross checking the estimates obtained from the asset pricing models. As noted above, the Alberta Utilities Commission made reference to a selection of these other metrics, as a means to inform decisions that are based on Sharpe-Lintner CAPM estimates.

6.1.2.1 The ERA's current view

135. In recent ERA decisions, the Sharpe-Lintner CAPM based on Australian domestic data has been adopted, reflecting its strong track record in estimating the return on equity.

6.1.3 Issues for Consideration

[38] The Sharpe Lintner CAPM uses the asset beta to describe the non-diversifiable returns of a particular asset. The higher the level of non-diversifiable risk, the higher is the required or expected rate of return. The systematic risk or non-diversifiable risk encompasses those risks faced by market as a whole, which cannot be reduced by diversification through a well constructed portfolio of assets.

[39] Economic Regulation Authority, August 2010, *Draft Decision on WA Gas Networks Revisions Proposal for the Access Arrangement for the Mid-West and South-West Gas Distribution Systems*, pp.126-133

[40] Australian Energy Regulator 2008, *Explanatory Statement: Electricity transmission and distribution network service providers: Review of weighted average cost of capital (WACC) parameters*, www.aer.gov.au, December, p. 51.

[41] Ibid.

136. The ERA is seeking views and supporting information from interested parties on the following issues:

23. What criteria could be used to select a model for estimating the return on equity that best meets the RoR objective and requirements?

24. Is it reasonable to rely on a single internally consistent model for determining the return on equity, or should a broader range of models and methods be used? If so, how might internal consistency be retained for the overall method?

25. Is the adoption of a domestic form of the CAPM – with foreign investors recognised only to the extent that they invest within Australia – appropriate from a theoretical and practical point of view? If not, what are the alternatives?

26. Would it be appropriate, feasible and practical to adopt either a fully segmented (domestic) or a fully integrated (international) version of the CAPM?

27. What other evidence on return on equity might be used as a cross-check to the estimates from financial models? What criteria might be applied to select these types of evidence?

28. Are there alternative approaches to estimating the cost of equity, other than the Sharpe-Lintner CAPM, which would better meet the new NGR RoR objective and requirements?

6.2 Market Risk Premium

137. The market risk premium (**MRP**) is the average expected return of the market – above the risk free rate – that investors require in return for their investment in a well diversified portfolio of risky assets. In other words, it is the premium that investors demand for investing in a market portfolio relative to the risk-free rate.

$$MRP = R_m - R_f$$

where:

R_m is the expected market return

R_f is the risk-free rate

6.2.1 Current Practices

138. Since the market risk premium is not directly observable, the preferred approach of Australian regulators has been to estimate the MRP using historical data on equity returns from the Australian stock market.

139. A study by Professor Handley of the University of Melbourne used historical data on equity returns from the Australian stock market and observed yields on 10-year CGS

for various periods from 1883 and 2011 to estimate the MRP.[42] This study concluded that a MRP of 6 per cent is appropriate over various periods of time. In this study, a 10-year term was adopted for the risk free rate.

140. The ERA conducted its own analysis using the same approach (that is, using historical data on the equity premium) to derive its own estimate of the MRP, but with a 5-year term for the nominal risk free rate. The findings from this study also indicate that a MRP of 6 per cent is appropriate.

141. In New Zealand the NZCC has surveyed MRPs, assuming a 10 year investment term.[43] The results from this survey have recently been cross checked against similar surveys of MRPs based on a 5 year term and the results of the two approaches were found to be consistent. Based on its studies, the NZCC has observed that the MRP increased temporarily in 2010 and 2011 due to the effect of the global financial crisis. However, more recent data suggests that the MRP has returned to more historic levels since June 2011.[44]

142. The Alberta Utilities Commission in Canada departed from using a long term average estimate of the MRP on the grounds that the risk free rate was far below its long term historical average. Reference was made to a survey of CAPM forecasts made by experts in order to determine a reasonable range.

143. UK regulator Ofgem used estimates of the equity risk premium for the UK from 1900 to 2009 based on calculations sourced from Dimson, Marsh and Staunton's 2006 study[45] and the Credit Suise Global Investment Returns 2010 Sourcebook.[46]

6.2.2 Discussion of Issues

144. There are several ways to estimate the MRP, though there is no general agreement as to the best approach. The three usual approaches are as follows.

- The first approach is the historical equity risk premium approach, which is a well-established method based on the assumption that the realised equity risk premium observed over a long period of time is a good indicator of the expected equity risk premium. This approach requires compiling historical data to find the average rate of return of a country's market portfolio and the average rate of return for the risk-free rate in that country.
- The second approach for estimating the MRP is the dividend discount model approach or implied risk premium approach, which is implemented using the Gordon growth model (also known as the constant-growth dividend discount model). For developed markets, corporate earnings often meet, at least approximately, the model assumption of a long-run trend growth rate. As a result, the expected return on the market is the sum of the dividend yield and the growth

[42] Handley John, 2012, *An Estimate of the Historical Equity Risk Premium for the Period 1883 to 2011*.

[43] Lally Martin, 2008, *The Weighted Average Cost of Capital for Gas Pipeline Businesses*, p.23.

[44] The market risk premium is expressed as a tax adjusted figure for use in the Brennan-Lally CAPM. The Brennan-Lally CAPM reflects New Zealand's taxation system, taking the value of imputation credits and the absence of taxes on capital gains into account. (See Commerce Commission New Zealand, December 2012, *Reasons Paper: Input Methodologies (Electricity Distribution and Gas Pipeline Services)*, p.147 and pp.477-507.)

[45] Dimson Elroy, Marsh and Staunton, 2006, *The Worldwide Equity Premium: A Smaller Puzzle.*

[46] Europe Economics, March 2011, Final Phase I Report*, The Weighted Average Cost of Capital for Ofgem's Future Price Control.*

rate in dividends. The MRP is therefore the difference between the expected return on the equity market and the risk-free rate.

- The third approach is the direct approach or survey approach. A panel of finance experts is asked for their estimates and the mean response is taken.

145. As noted above, the market risk premium is not directly observable. In the context of estimating the cost of capital for a regulated business for its future regulatory control period, it is required that the estimate of the MRP should be a forward looking estimate, given the requirement to have regard to the 'prevailing conditions in the market for equity funds'.[47] When the ERA has considered this issue in the past, it came to the view that using historical data on the equity premium does not mean that the estimate of the MRP is a backward looking estimate: this method simply assumes that investors form their expectation (a forward looking concept) based on experience (by using historical data on equity returns).

146. Using historical data on equity premiums to estimate the forward looking MRP implicitly assumes that investors form their forward looking MRP by experience and that the past is the best proxy for the future.

147. In Australia, new methods have emerged which aim to estimate the MRP – generally as the result of consultants' work for regulated businesses – that are different to the existing historical data method and the survey methods. These new methods include Capital Research's DGM estimates;[48] NERA's regime switching model;[49] and VAA's implied volatility glide path approach.[50]

6.2.3 Interrelationship between the risk-free rate and the MRP

148. Over the last two years, the risk-free rate of return has been at a relatively low level due to a "flight to quality" into the CGS market. As such, the cost of debt and cost of equity have been relatively lower in the regulatory decisions in Australia in comparison with those issued more than two years ago because the risk free rate of return is a direct input into both estimates.

149. While the risk free rate of return has been lower over the last two years, the MRP of 6 per cent has remained unchanged in regulatory decisions over the period.

150. Given the observations of a lower risk free rate and an unchanged estimate of the MRP, some regulated businesses have suggested that a long-term average sampling period of 5 years or so for the risk free rate is more appropriate than the 20 trading day average. They have argued that there is a negative relationship between the risk free rate of return and the MRP, and that the MRP must be revised upwards to compensate for a decrease in the estimate of the risk free rate.

---

[47] Australian Energy Market Commission 2012, *National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012 No. 3,* www.aemc.gov.au, 87(6).

[48] This method examines the forecasted future dividends of selected businesses and derives the cost of equity that makes these forecasted dividends consistent with the market valuation of the equity of those businesses.

[49] This model is highly complex and involves the following steps: (i) determining the appropriate assumptions of high- and low-volatility states; (ii) estimating the current probability of being in the high-volatility state; (iii) using a Markov chain to roll over this probability; (iv) calculating a short term MRP in relation to the three month bill return; (v) estimating a forward one-year bill rate; and (vi) converting the short term MRP to a five-year MRP.

[50] This method derives the one-year MRP from the Black-Scholes option pricing for 12-month ASX200 index call options.

6.2.3.1 The ERA's current view

151. In recent ERA decisions, an MRP of 6 per cent based on an average of historical data has been adopted as a long term forward looking estimate.

6.2.4 Issues for Consideration

152. The ERA is seeking views and supporting information from interested parties on the following issues:

29. What criteria should be used to select a model/approach for estimating the Market Risk Premium?

30. What is the best method to be used in estimating the MRP?

31. Are there any other methods that could be adopted for estimating the MRP, which the ERA has not presented in the previous section?

32. When using historical data, what is the relevant sampling period given that: (i) there are significant increases in the quality of data on equity returns becoming available in more recent periods; and (ii) recent periods may be more relevant to the current financial environment in Australia?

33. Are there any theoretical grounds for an inverse relationship between the risk-free rate of return and the MRP?

34. When the risk-free rate of return is low/high, should the MRP be revised upwards/downwards? If yes, what is an unbiased mechanism for doing so? What is the threshold of the risk-free rate in which the prevailing risk-free rate can be considered low?

35. Is there a method to calculate the MRP, other than using an average of historical data, which would better meet the new NGR RoR objective and requirements?

6.3 Equity Beta

153. The systematic risk (beta) of a firm is the measure of how the changes in the returns to the firm's stock are related to the changes in returns to the market as a whole. Systematic risks are those risks that cannot be costlessly eliminated through portfolio diversification, such as risks relating to unexpected changes in real aggregate income, inflation and long-term real interest rates.

154. The most common formulation of the CAPM directly estimates the required return on the equity share of an asset as a linear function of the risk free rate plus a component to reflect the risk premium that investors would require over the risk free rate:

$$R_e = R_f + \beta_e \left(R_m - R_f \right)$$

where R_e is the required rate of return on equity, R_f is the risk-free rate, β_e is the equity beta that describes how a particular portfolio i will follow the market and is defined as $\beta_e = \text{cov}(r_i, r_M)/\text{var}(r_M)$; and $(R_m - R_f)$ is the market risk premium.

155. The above equation reveals that the equity beta of a particular asset will scale the MRP up (when its value is greater than one) or down (when its value is lower than one) to reflect the risk premium, which is over and above the risk-free rate, that equity holders would require to hold that particular risky asset in the investor's well-diversified portfolio.

6.3.1 Current Practices

156. The ERA's method for developing its equity beta estimates follows that developed by Professor Henry from the University of Melbourne for the AER.[51] For its estimates, the ERA utilises data for Australian Stock Exchange listed companies with business activities related to utilities. Both Ordinary Least Squares and Least Absolute Deviation regressions are carried out. The latter is an attempt to reduce the effect of outliers. The results are de-levered and re-levered to reflect a 60 per cent gearing level. Equal- and value-weighted portfolio betas are estimated to mitigate any company specific anomalies. Dimson's betas are estimated to test whether any of the estimates suffer from thin trading.

157. On this basis, the ERA has recently conducted a study using updated data until April 2012. The findings suggest that the equity beta at a gearing of 60 per cent for a regulated business operating in the energy industry, based on weekly data, range from 0.3 to 0.7, with a mean of 0.5.

158. This compares with Professor Henry's 2008 study for the AER, which concluded that the equity beta falls with the range of 0.4 and 0.7. Despite these findings, the AER's May 2009 WACC review estimate of an equity beta for its electricity transmission and distribution businesses was 0.8. The AER took into account a range of other submissions in reaching its decision.

6.3.2 Discussion of Issues

159. As noted above, empirical studies on the estimates of equity beta using historical data have relied on estimates of the returns for each stock in the sample and for the Australian financial market as a whole, for which the ASX 200 provides a proxy. The industry sample used in these empirical studies include both electricity and gas businesses in Australia. This methodology has presented a wide range of estimates.

160. A further issue relates to the endogeneity of observed equity betas and the form of regulation.[52] This increases the challenges for accurately estimating the equity beta.

6.3.2.1 The ERA's current view

161. In its most recent work, the ERA has derived the estimate of the equity beta through analysis of observations from a sample of Australian energy businesses.[53]

[51] Henry Olan, 2009, Estimating Beta, *Advice Submitted to the Australian Competition and Consumer Commission*.

[52] Blake M.S. and Fallon J. 2012, The Form of Regulation and Non-diversifiable Risk, *Network*, Issue 44, June, www.accc.gov.au, p. 1.

6.3.3 Issues for Consideration

162. The ERA is seeking views and supporting information from interested parties on the following issues:

36. What criteria could be used to help select a model/approach for estimating the equity beta?

37. Should the estimate of equity beta be based on a sample of businesses that only includes regulated utility businesses?

38. Results from the econometric evaluation of historic market returns as a means to estimate the equity beta are quite sensitive to input data. What is the best way to determine the point estimate of the equity beta from the resulting wide range of estimates (i.e. median, average, any relevant quartiles)?

39. Are there any viable alternative methods to the econometric evaluation of historic market returns, such that the equity beta for regulated businesses might be estimated in a more robust manner? If so, would the alternative method better meet the new NGR RoR objective and requirements?

7 The return on debt

163. The generally accepted approach to estimating the return on debt involves estimating debt risk premium, which is added to the estimate of the risk free rate. Key components in estimating the return on debt include:

- the credit rating of the benchmark service provider;
- the resulting debt risk premium of the benchmark service provider; and
- debt raising costs.

164. Australian economic regulators have consistently adopted this method for determining the cost of debt. However, an alternative approach – adopted by overseas regulators such as Ofgem and NZCC – is to estimate the cost of debt directly from a sample of corporate bonds (without separately identifying the risk free rate or debt risk premium).

165. Approaches to estimating each of these components are considered in what follows.

7.1 Credit Rating

166. Credit ratings provide a broad classification of a business's probability of defaulting on its debt obligations. This probability is one of the most important factors that investors consider when pricing business debt. A business with a higher probability of default, other things constant, will have a lower credit rating. Accordingly, that business will

[53] Economic Regulation Authority 2012, *Final Decision on Proposed Revisions to the Access Arrangement for the Western Power Network*, September, p.408.

face a higher cost of debt as investors demand a premium to compensate them for the higher risk of default.

7.1.1 Current Practices

167. The benchmark credit ratings for regulated businesses in gas and electricity transmission and distribution are generally rated at BBB+. This is a standard practice for Australian utility regulators who have relied on the findings from the Weighted Average Cost of Capital (**WACC**) Review in 2009 by the AER. In that WACC Review, the AER considered that a sample of Australian energy network service providers were the best comparators for determining a credit rating and further, that a median approach should be used.[54]

168. However, in its most recent decision for Western Power, a government-owned electricity transmission and distribution network in Western Australia, the ERA adopted the benchmark credit rating based on a sample that included BBB, BBB+ and A- bonds.[55] The ERA's decision relied on the most recent Bloomberg credit ratings, sampled at the time of the final decision, for all Australian rated utilities.

169. Benchmarking exercises have been used by overseas regulators. Canadian regulators such as the AUC have adopted the credit rating of A- for gas businesses.[56] The NZCC has adopted BBB+ as the benchmark credit rating[57], whereas Ofgem has adopted credit ratings in a range of A and BBB credit ratings.[58]

7.1.2 Discussion of Issues

170. The key issue for determining a benchmark credit rating is to determine the benchmark sample of Australian entities and/or their debt instruments, from which their latest credit ratings can be observed. This is an important starting point. There are two different potential samples of the so-called Australian utilities, as developed by: (i) S&P in their industry reports; and (ii) the classifications adopted by Bloomberg. There are significant differences in the results for the resulting benchmark sample of Australian utilities, depending on which source is adopted. An initial investigation by the ERA suggests that a list of Australian utilities presented in S&P's industry report cards is more appropriate. This list is at Appendix C.[59]

171. Credit ratings are not available for all companies in the benchmark sample. Credit ratings may not be available year after year for the same company. In addition, credit ratings for some Australian entities and/or debt instruments may not be relevant as they were issued by international rating agencies such as S&P's or Moody's a long time ago. It is unclear how far back the credit ratings can go while still being considered relevant.

---

[54] Australian Energy Regulator, May 2009, *Final Decision, Electricity transmission and distribution network service providers, Review of the weighted average cost of capital (WACC) parameters*, p. 390.

[55] Due to a small sample of A- minus rated bonds, BBB and BBB- bonds were introduced into the sample to create the debt risk premium.

[56] Alberta Utilities Commission 2011, *2011 Generic Cost of Capital*, Decision 2011-474, 'Credit Metrics associated with an 'A' Range', p. 35.

[57] Commerce Commission New Zealand 2012, *Cost of Capital Determination for Electricity Distribution Businesses to Apply to a Customised Price-Quality Path Proposal*, September, NZCC 25, p. 6.

[58] Ofgem 2011, *Decision on Strategy for the Next Transmission and Gas Distribution Price Controls - RIIO-T1 and GD1 Financial Issues*, March, p. 2.

[59] Bloomberg classifies 34 companies as utilities. S&P classifies 22 companies as utilities.

172. As such, it appears that the benchmark sample of the Australian companies and/or their debt instruments should cover as many entities/instruments as possible to determine the benchmark credit rating. In addition, the most recent credit ratings should be used to better reflect the current ratings of the associated companies in the sample.

173. From the observed credit ratings for the entities and instruments, the "average" of these observed credit ratings can be used as a benchmark credit rating for regulated businesses. It appears that the "median" of the observed credit ratings is preferred by Australian economic regulators.

174. Since it is difficult to precisely derive a benchmark credit rating from the observed credit ratings of the benchmark sample, some cross-check analysis is required to ensure the robustness of the benchmark credit rating. S&P's and Moody's financial indicator matrices may be relevant for this exercise. In addition, other quantitative approaches such as the method that uses historical financial indicators to rank all companies in terms of their financial strengths in an unbiased manner may also be relevant.

7.1.2.1 The ERA's current view

175. In recent gas decisions, a credit rating of BBB+ has been adopted by the ERA, based on a benchmarking exercise applied to a sample of Australian companies operating in electricity and gas industries.[60] However, recent work to update the credit ratings of the benchmark sample using the same approach suggests that the outcomes may change for future access arrangements.

7.1.3 Issues for Consideration

176. The ERA is seeking views and supporting information from interested parties on the following issues:

[60] It is noted that the same method had been used for electricity recently and the credit rating of A- was observed.

40. What criteria might be used to help select an approach for determining the credit rating?

41. What are the key characteristics or the selection criteria for companies to be included in the benchmark sample to determine the credit rating for a regulated business in gas transmission and distribution?

42. Is the S&P list of Australian utilities a good starting point for forming a benchmark sample?

43. Among the different types of credit rating for the same company, for example, entity credit rating (i.e. the credit rating for the entire entity) versus instruments credit rating (i.e. the credit rating for a particular debt instrument), which type is more appropriate for determining the RoR?

44. How recent should the credit ratings for the company and debt instruments be in order to be considered valid as an input to determining credit ratings? How many years credit ratings assigned in the past can be used?

45. Is the median of credit rating of a benchmark sample the best indicator for the credit rating of a regulated business in gas industry? If not, then which is the best method to determine the credit rating from the benchmark sample?

46. What methods are suitable as a cross-check of the robustness of a determination of a credit rating for a regulated business?

47. Are there alternatives to the ERA's current method for estimating the credit rating that would better meet the new NGR RoR objective and requirements?

7.2 Debt Risk Premium

177. The focus of this section is on the estimate of the debt risk premium. The debt risk premium (also referred to as the debt margin) is a margin above the risk free rate of return reflecting the risk in providing debt finance.

7.2.1 Current Practices

178. The ERA has adopted its bond-yield approach in deriving the debt risk premium, following the Final Decision on Western Australian Gas Network (**WAGN**, now known as ATCO) in 2011. The fundamental principle of the bond-yield approach is to select Australian corporate bonds, which satisfy a set of unbiased selection criteria, to form the benchmark sample. Details are discussed in the next section. The observed yields of the bonds included in the benchmark sample are used as the basis for the estimate of the debt risk premium for regulated businesses.[61]

[61] Economic Regulation Authority 2011, *Final Decision on WA Gas Networks Pty Ltd Proposed Revised Access Arrangement for the Mid-West and South-West Gas Distribution Systems*, February, pp. 78-79.

179. IPART has also adopted a similar approach in which the observed yields of corporate bonds and Bloomberg's fair value curve are central to the approach.[62]

180. Other Australian regulators including the AER and Essential Services Commission of South Australia (**ESCOSA**) have used Bloomberg's estimate of fair value curves in deriving the debt risk premium. The Essential Services Commission (**ESC**) in Victoria has consistently adopted the benchmark debt margin range which was based on lending rates of Treasury Corporation of Victoria (**TCV**). The ESC considered the TCV lending rates appropriate because their regulated businesses only borrow from the TCV as opposed to private debt markets. The Queensland regulator, QCA, currently uses the CAPM in deriving the debt risk premium, taking into account liquidity and default premium, in deriving the debt risk premium based on the advice of Professor Lally from the University of Wellington in New Zealand.[63]

181. Overseas regulators such as NZCC have also adopted a similar approach to the ERA's bond-yield approach.[64] In NZCC's method, the debt risk premium is calculated as the spread between corporate bonds and NZ government bonds. The bid yields to maturity for NZ corporate bonds, issued by an electricity or gas distribution business, denominated in NZ dollars, publicly traded, and with a remaining maturity of five years, are used. With regard to the NZ government bonds, bid yields are contemporaneously interpolated for the remaining term to maturity of 5 years.

182. For the UK regulators, Ofgem has used the real cost of debt calculated directly from iBoxx data, a fixed income benchmark indices, which is deflated using the Bank of England's 10 year break even inflation index. The iBoxx indices consist of an average of the non-financial sector's broad A and BBB rated corporate bonds.

183. The Alberta Utilities Commission determines the cost of equity independently of the cost of debt. The debt risk premium plays an indirect role through qualitative adjustments made to the return on equity with respect to returns available on high grade corporate bonds.[65]

7.2.2 Discussion of Issues

184. Bloomberg's estimates of fair value curves (**FVC**) for BBB credit rated Australian corporate bonds have presented significant deviations from the observed yields for Australian corporate bonds. Since the method used by Bloomberg to derive its fair yield curves is not released to the public, it is not possible to understand and verify these differences.

185. In the ERA's alternative bond-yield approach, a lack of corporate bonds issued by Australian utilities was recognised. As such, the more practical set of selection criteria to determine the benchmark sample of Australian corporate bonds was adopted. Taking into account the Australian CompetitionTribunal's view on the bond-yield approach, the benchmark sample is developed based on the following selection criteria, using Bloomberg's terminal:

- credit rating of BBB/BBB+ by Standard & Poor's;
- time to maturity of 2 years or longer;

[62] Economic Regulation Authority 2011, *Final Decision on WA Gas Networks Pty Ltd Proposed Revised Access Arrangement for the Mid-West and South-West Gas Distribution Systems*, February, pp. 78-79.
[63] Lally M. 2011, *The Estimated WACC for the SEQ Interim Price Monitoring*, p. 19.
[64] Commerce Commission New Zealand 2012, *Cost of Capital Determination for Electricity Distribution Businesses to Apply to a Customised Price-Quality Path Proposal*, 2012 NZCC 25, September.
[65] Alberta Utilities Commission 2011, *2011 Generic Cost of Capital, Decision 2011-474*, December, p. 24.

- bonds issued in Australia by Australian entities and denominated in Australian dollars;
- inclusion of both fixed bonds[66] and floating bonds;[67] and
- inclusion of both Bullet and Callable/ Put-able redemptions.[68]

186. From the observed yields of Australian corporate bonds in the benchmark sample, an average debt risk premium is estimated. The current bond-yield approach indicates that any bond with a longer term to maturity and a larger issuance should be assigned a higher weight in the sample. As such, it is appropriate to use the *multiplicative rule* to account for this compounding effect.

187. It appears that there is a slight difference regarding the credit ratings between S&P's and Moody's – the two key players in the international credit rating market (see Appendix C). A preliminary investigation indicates that, within the credit rating of interest (for example with BBB/BBB+), more companies will be included in the benchmark sample of the bond-yield approach if both S&P's and Moody's credit ratings are considered. However, a drawback arises with this combination where there is a significant difference in the credit rating assigned to the same company (for example, S&P's produces the credit rating of BBB whereas Moody's presents a credit rating of A3 (which is equivalent to S&P's credit rating of A-). It is unclear that the extra benefit (of a larger sample size) outweighs the extra "cost" (reflecting the lack of consistency of credit ratings).

188. The ERA's alternative bond-yield approach has been upheld by the Australian Competition Tribunal in its most recent decisions in 2012.[69]

189. The ERA recognises that the AEMC has amended the NGR to allow estimates of the return on debt to incorporate trailing historical average approaches, and also to allow annual updates. Such approaches recognise that a benchmark service provider may hold a portfolio of debt instruments, of different tenors. There is a range of potential trailing average approaches; for example, approaches may be based on observations of the overall return on debt of a benchmark sample, or on just the debt risk premium.

7.2.2.1 The ERA's current view

190. The ERA has adopted the bond-yield approach over the last two years.

7.2.3 Issues for Consideration

[66] This is a long term bond that pays a fixed rate of interest (a coupon rate) over its life.

[67] This is a bond whose interest payment fluctuates in step with the market interest rates, or some other external measure. Price of floating rate bonds remains relatively stable because neither a capital gain nor capital loss occurs as market interest rates go up or down. Technically, the coupons are linked to the bank bill swap rate (BBSW) (it could also be linked to another index, such as LIBOR), but this is highly correlated with the RBA's cash rate. As such, as interest rates rise, the bondholders in floaters will be compensated with a higher coupon rate.

[68] A callable (put-able) bond includes a provision in a bond contract that give the issuer (the bondholder) the right to redeem the bonds under specified terms prior to the normal maturity date. This is in contrast to a standard bond that is not able to be redeemed prior to maturity. A callable (putable) bond therefore has a higher (lower) yield relative to a standard bond, since there is a possibility that the bond will be redeemed by the issuer (bondholder) if market interest rates fall (rise).

[69] Australian Competition Tribunal 2012, *Application by WA Gas Networks Pty Ltd (No 3) [2012] ACompT 12*, 8th June 2012, paragraph 179, pp. 45-46.

191. The ERA is seeking views and supporting information from interested parties on the following issues:

> *48. What criteria could be used to select an approach/a model for deriving the debt risk premium?*
>
> *49. Are there any issues associated with the bond-yield approach that have not been considered by the ERA?*
>
> *50. Should Moody's credit ratings of Australian corporate bonds be included in the selection criteria for the benchmark sample?*
>
> *51. If the bond-yield approach was to be adopted, should the current joint-weighting approach be retained, or else an alternate weighting approach be considered? Are there any other issues the ERA should consider with regard to the average of the debt risk premium?*
>
> *52. Would a method other the ERA's bond yield approach better meet the new NGR RoR objective and requirements?*

7.3 Debt Raising Costs

192. Debt raising costs may include underwriting fees, legal fees, company credit rating fees and any other costs incurred in raising debt finance. In practice, regulators across Australia have typically included an allowance of 12.5 basis points for these costs in the cost of debt, as an increment to the debt margin.

7.3.1 Current Practices

193. The current allowance for debt raising costs of 12.5 basis points is based upon a benchmark analysis conducted by the Allen Consulting Group (**ACG**) in 2004.[70] The ACG undertook a study for the Australian Competition and Consumer Commission (**ACCC**) in 2004 on appropriate debt and equity raising costs to be included in costs recognised for the purposes of determining regulated revenues and prices. This study determined debt raising costs based on long-term bond issues, consistent with the assumptions applied in determining the costs of debt for a benchmark regulated entity. Debt raising costs were based on costs associated with Australian international bond issues and for Australian medium term notes sold jointly in Australia and overseas. Estimates of these costs were equivalent to 8 to 10.4 basis points per annum when expressed as an increment to the debt margin.[71] However, Australian regulators have adopted a debt raising cost of 12.5 basis points.

7.3.2 Discussion of Issues

194. Australian regulators have used the findings from the 2004 ACG study on debt and equity raising costs in their regulatory decisions. It is noted that this study may become outdated for future regulatory decisions in Australia. In addition, it is noted that sources used in that study are no longer available for an update of the study.

---

[70] Allen Consulting Group 2004, *Debt and Equity raising transaction costs: Final report to ACCC*, December.

[71] Ibid.

195. It appears that using debt raising costs provided by regulated businesses is problematic because these estimates are simply presented from an estimate of a particular investment bank. It is unclear that this estimated figure is derived from an unbiased manner and reflects the efficient financing decisions by regulated businesses.

7.3.3 Issues for Consideration

196. The ERA is seeking views and supporting information from interested parties on the following issues:

53. What criteria could be used to select an approach/a model for estimating debt raising cost?

54. What data source is best to gather evidence of debt raising costs incurred by businesses when they use debt financing to finance their capital programs?

55. Are there alternatives to the ACG method for estimating the debt raising costs that would better meet the new NGR RoR objectives and requirements?

8 Gamma

197. The ERA is required by the new NGR to set out its approach to estimating the value of imputation credits.[72]

198. A full imputation tax system for companies was adopted in Australia on 1 July, 1987. While Australia and New Zealand have full imputation tax systems (which are discussed below), many other countries have a partial imputation system, where only partial credit is given for company tax.

199. Under the tax system of dividend imputation, a franking credit is received by Australian resident shareholders, when determining their personal income taxation liabilities, for corporate taxation paid at the company level. In a dividend imputation tax system, the proportion of company tax that can be fully rebated (credited) against personal tax liabilities is best viewed as personal income tax collected at the company level. With the full imputation tax system in Australia, the company tax (corporate income tax) is effectively eliminated if all the franking values are used as credits against personal income tax liabilities.

200. It is widely accepted that the approach adopted by regulators across Australia to define the value of imputation credits, known as "gamma" γ, includes two components of gamma: (i) the payout ratio (F); and (ii) theta (θ).

201. As a result, the actual value of franking credits, represented in the WACC by the parameter 'gamma', depends on the proportion of the franking credits that are created

[72] Australian Energy Market Commission 2012, *National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012 No. 3,* www.aemc.gov.au, 87(14).

by the firm and that are distributed (the payout ratio, F), and the value that the investor attaches to the credit (theta), which depends on the investor's tax circumstances (that is, their marginal tax rate). As these will differ across investors, the value of franking credits may be between nil and full value (i.e. a gamma value between zero and one). A low value of gamma implies that shareholders do not obtain much relief from corporate taxation through imputation and therefore require a higher pre-tax income in order to justify investment.

8.1.1 Current Practices

202. SFG Consulting's 2011 study on the estimates of theta was adopted by the Australian Competition Tribunal. This study has used a dividend drop off technique to estimate the value of theta for Australia.

203. After the Tribunal's decisions on the application by Energex Limited on the issues of distribution ratio and gamma, the AER and the ERA have adopted the payout ratio of 0.70[73] and a theta of 0.35,[74] producing a gamma of 0.25, to be consistent with the Tribunal's decision. However, in its recent decisions, the ERA has indicated that the issue needs to be revisited.

204. Other Australian regulators such as the ESC adopt different values of gamma. For example, the ESC in Victoria adopted a gamma of 0.5. This figure is based on an assumption that only 80 per cent of imputation credits on average can be distributed and that the credits have a value of 60 cents per dollar.[75]

8.1.2 Discussion of Issues

205. The estimate of gamma, or more specifically, theta, has attracted significant debate among parties involved for an extensive period of time. In an attempt to estimate the value of theta using the dividend drop-off technique, the following studies are available in Australia.

206. It appears that estimates of gamma vary significantly from study to study even though all apply the dividend drop-off technique. It has been noted that the choice of filtering of the dataset has a significant impact on the estimated value of theta.

[73] Australian Competition Tribunal, 2010, *Application by Energex Limited (Distribution Ratio (Gamma)) (No. 3) [2010] AcompT 9.*

[74] Australian Competition Tribunal, 2011, *Application by Energex Limited (Gamma) (No. 5), [2011] AcompT 9.*

[75] Essential Services Commission Victoria 2011, *2013 Water Price Review,* October, p.66.

Table 3 Studies on the Estimates of Gamma using Dividend Drop-off Methods

Author	Year	Data	Techniques	Gamma
Brown & Clarke[76]	1993	Statex, Melbourne and Australian Stock Exchange publications, 1973 - 1991	OLS Regression	0.72
Walker & Partington[77]	1999	Securities Industry Research Centre of Asia-Pacific, 1995 to 1997	Not Specified	0.88 – 0.96
Hathaway & Officer[78]	1999	Australian Tax Office and ASX/S&P 500, 1986 - 2004	Generalised Least Squares	0.44 – 0.49
Bellamy & Gray[79]	2004	1995 -2002	Unknown	0.00
Beggs & Skeels[80]	2006	CommSec Share Portfolio 1986 - 2004	Generalised Least Squares	0.57
SFG[81]	2007	Securities Industry Research Centre of Asia-Pacific and FinAnalysis, 1998 - 2006	Generalised Least Squares	0.40
Feuerherdt, Gray & Hall[82]	2010	Securities Industry Research Centre of Asia-Pacific, 1995 - 2002	Generalised Least Squares	0.00
SFG[83]	2011	DatAnalysis, 2000 -2010	Generalised Least Squares	0.00 – 0.35

Source: ERA

[76] P Brown & A Clarke 1993, 'The Ex-Dividend Day Behaviour of Australian Share Prices Before and After Dividend Imputation', *Australian Journal of Management*, 18 1.

[77] S Walker & G Partington 1999, 'The Value of dividends: Evidence from cum-dividend trading in the ex-dividend period', *Accounting and Finance*, vol 39, pp 275–96.

[78] NJ Hathaway & RR Officer 1999, *The Value of Imputation Tax Credits,* working paper, Melbourne Business School.

[79] D Bellamy & S Gray 2004, *Using stock price changes to estimate the value of dividend franking credits*, 3 March, p 26.

[80] DJ Beggs & CL Skeels 2006, 'Market Arbitrage of Cash Dividends and Franking Credits', *The Economic Record*, vol 82, no 258, pp 239–252.

[81] Strategic Finance Group (SFG) 2007, *The impact of franking credits on the cost of capital of Australian companies*, Report prepared for Envestra, Multinet and SP AusNet, October, pp 35, 45.

[82] C Feuerherdt, S Gray & J Hall 2010, 'The Value of Imputation Tax Credits on Australian Hybrid Securities', *International Review of Finance*, 10:3, p 365.

[83] SFG 2011, *Dividend drop-off estimate of theta, Final Report*, 21 March.

8.1.2.1 The ERA's current view

207. The dividend drop-off technique provides a market based approach for estimating the value of imputation credits. However, the ERA recognises that the technique has significant issues in terms of robustness.

8.1.3 Issues for Consideration

208. The ERA is seeking views and supporting information from interested parties on the following issues:

56. What criteria should be used to select an approach/ model for estimating gamma?

57. What are the best methods and/or studies for estimating the value of gamma?

58. What are the main rationales for estimating gamma via the estimates of the payout ratio and theta? Is it possible to estimate gamma directly from available market data?

59. Are there methods – other than for dividend drop off studies – which could estimate the value imputation credits and better meet the new NGR RoR objective and requirements?

Appendix A Models for estimating the return on equity

1. There are a range of approaches for estimating the return on equity. These include:
   - Sharpe-Lintner Capital Asset Pricing Model (**CAPM**);
   - Black CAPM;
   - Fama-French Three-Factor Model (**FFM**);
   - Zero-beta Fama French Model.
2. In addition, there are a range of alternatives for estimating the return on equity. These include:
   - the discounted cash flow model;
   - estimated market returns on comparable businesses;
   - price to book ratios.
3. Each of these models is briefly summarised in what follows.

The Asset Pricing Models

4. The CAPM can be traced back to its first version in 1956, which became known as the Sharpe-Lintner CAPM after its developers.

Sharpe-Lintner CAPM

5. The Sharp-Lintner CAPM explains the expected return, $E(r_t)$, on any financial asset i in terms of the rate of return on a risk-free asset, r_f, and a premium for risk, $\left(E(r_M)-r_f\right)\times\beta_i$, where $E(r_M)$ is the expected rate of return on a market portfolio of assets, the term $\left(E(r_M)-r_f\right)$ represents the market risk premium (**MRP**) and β_i is the equity beta of asset i and is defined as $\beta_i=\text{cov}(r_i,r_M)/\text{var}(r_M)$:

$$r_e = r_f + \left(E(r_M)-r_f\right)\times\beta_i$$

Black CAPM

6. The Black CAPM was developed from the Sharp-Lintner CAPM, but without assuming the existence of a risk free rate asset and without assuming unrestricted borrowing and lending. In Black's derivation of CAPM, the return on a portfolio, known as zero-beta portfolio $\left(E(r_z)\right)$, for which the return is uncorrelated with the return on the market portfolio, acts as the equivalent of the risk free return.

$$r_e = E(r_z) + \left(E(r_M)-E(r_z)\right)\times\beta_i$$

7. The main findings from the Black CAPM are that: (i) when β is low, the expected return predicted by the Sharp-Lintner CAPM is less than the expected return predicted by the Black CAPM; and (ii) when β is high, the expected return predicted by the Sharp-Lintner CAPM is greater than the expected return predicted by the Black CAPM.

Fama-French Three-Factor Model

8. The Fama-French Three-Factor Model (**FFM**) identifies three sources of undiversifiable risk that address all three above-mentioned anomalies:

   - The excess return to the market portfolio (the market risk premium, MRP);
   - The value or growth risk premium, high minus low (**HML**) – the premium earned by HML book value shares. In this asset pricing model, high-value firms have a high ratio between book value of equity and market value of equity whereas the opposite is true for low-value firms (also known as growth shares); and
   - The size risk premium, small minus big (**SMB**) – the premium earned by SMB shares. Small (big) firms have small (big) total capitalisation (i.e. equity at market value).

$$r_e = r_f + \left(E\left(r_M\right) - r_f\right) \times \beta_m + HML \times h + SMB \times s$$

9. The FFM states that small firms and firms with high book-to-market ratios require additional returns to compensate investors for these additional risks. Accordingly, large firms and firms with a low book-to-market ratio have less risk and therefore investors require a lower rate of return.

Zero-beta Fama French Model

10. The Zero-beta Fama-French Model is a combination of selected elements from both the Black CAPM and the FFM in which a zero-beta portfolio from Black CAPM is used instead of the risk-free rate of return from Fama-French CAPM.

$$r_e = E\left(r_z\right) + \left(E\left(r_M\right) - r_z\right) \times \beta_m + HML \times h + SMB \times s$$

Other models for estimating the rate of return

Discounted Cash Flow Model

11. The discounted cash flow (**DCF**) model is used to estimate the required return on equity by predicting expected dividends of a company's shares plus expected future dividend growth rates. The return on equity (**ROE**) is the rate of return that equates the present value of the estimated future stream of dividends with the current share price observed from the market. The fundamental issues with this approach relate to the treatment of expected dividends and the expected dividend growth rate for a particular company.

Market returns on comparable investments

12. Another cross check is to consider a return on equity for comparable investments to regulated business. However, it is noted that the evidence on comparable investments is generally inconclusive regarding the return investors expect and there is no evidence to suggest that these returns are sufficiently comparable to the regulated utilities.

Price-to-Book ratios

13. Evidence is presented linking the equity-to-book ratio (the market to book ratio) to the return to equity. It is generally agreed that a market-to-book ratio that is greater than 1 indicates that the earned ROE is higher than the allowed cost of equity.

Appendix B Australian Utilities Classified by S&P's and Bloomberg

Company Name	Company Description	Utilities Industry Classification
APT Pipelines Ltd	The Issuer is a fully owned subsidiary of Australian Pipeline Trust. The Issuer is the borrowing entity of APA Group. APA Group invests in various energy investment enterprises and provides asset management and operational services for the majority of these investments.	S&P
DBNGP trust	Is the owner of the Dampier-to-Bunbury natural gas pipeline.	S&P
DUET group	Investment in energy utility assets principally in Australia and New Zealand.	S&P
ETSA Utilities Finance Pty Ltd	ETSA Utilities Finance Pty Ltd. is based in Keswick, Australia. ETSA Utilities Finance Pty Ltd. operates as a subsidiary of SA Power Networks.	S&P
Electranet Pty Ltd	ElectraNet is a private limited liability company which owns and manages the South Australian electricity transmission system.	S&P
Energy Partnership (Gas) Pty Ltd	Energy Partnership (Gas) Pty Ltd. engages in gas distribution. The company was incorporated in 1999 and is based in Mount Waverley, Australia. Energy Partnership (Gas) Pty Ltd. operates as a subsidiary of DUET Group.	S&P
Ergon Energy Corp. Ltd	Ergon Energy Corporation Limited is an Australian Government-owned corporation that principally involved in electricity transmission and distribution in Queensland.	S&P
Loyvic Pty Ltd	Is the financing arm of the Loy Yang B (LYB) power plant, in Victoria's Latrobe Valley region.	S&P
Origin Energy Ltd	Origin is the leading Australian energy retailer, providing competitively priced products including electricity, natural gas, LPG, solar panels and green energy.	S&P and Bloomberg
Powercor Australia Holdings Llc	Powercor is the holding company that indirectly owns 100% of Powercor Australia Ltd., the largest of Victoria's five electricity-distribution businesses by geographical coverage.	S&P
Redbank Project Pty Ltd	Redbank Project Pty. Limited engages in the generation and sale of electricity to the whole sale electricity market in Australia. Limited was founded in 2000 and is based in Warkworth, Australia	S&P
Rowville Transmission Facility Pty Ltd	RTF owns and operates a power switch-yard facility in the State of Victoria	S&P
SP Ausnet group	The company is involved in the distribution of electricity to approximately 642,000 consumer connection points over 80,000 square kilometers in eastern Victoria, including eastern metropolitan region of Melbourne; and the transmission of electricity from power stations to electricity distributors through its electricity transmission network consists of the transmission lines and towers in the state of Victoria.	S&P
SPI (Australia) Assets Pty Ltd	SPI (Australia) Assets Pty Ltd is a foreign owned private company that has investments in energy infrastructure and infrastructure services for owners of electricity, gas and water assets.	S&P
Snowy hydro Ltd	Snowy Hydro Limited owns and operates the Snowy Mountains Hydro-Electric Scheme, an integrated water and hydro-electric power operation located in the Kosciusko National Park, in NSW and Victoria.	S&P
Synergy	Synergy is a Western Australian electricity retailer.	S&P
Energy Australia (formally Truenergy Pty Ltd)	EnergyAustralia Holdings Pty Ltd provides power to around 2.7 million residential and commercial customers in Australia, primarily in New South Wales, South Australia and Victoria. The company generates stores and retails gas and electricity.	S&P
The Citipower Trust	CitiPower is a Melbourne-based regulated Victorian electricity-distribution business. It owns and operates a distribution network that services a relatively small area of 155 square kilometres, covering Melbourne's central business district and surrounding suburbs	S&P
WA Network	WA Network Holdings Pty Ltd., through its subsidiary, owns and operates gas	S&P

Holdings Pty Ltd	distribution systems in Australia.	
Jemena Ltd	Jemena Ltd. conducts infrastructure management and development services. The Company offers the construction, operation, and maintenance of electricity distribution and transmission networks, gas transmission and distribution networks, and recycled water systems. Jemena serves customers throughout Australia.	Bloomberg
United Energy Distribution Pty. Ltd	United Energy Distribution Pty. Ltd. distributes and sells electricity. The Company markets its electrical power to customers in the Melbourne, Australia area.	S&P and Bloomberg
Energy Developments Ltd	Energy Developments Limited provides renewable energy and low greenhouse gas emission energy. The Company provides services to landfill gas power generation, coal mine methane power generation, and remote area power generation. Energy Developments has operations in Australia, the United States, Europe, and Asia.	Bloomberg
Envestra Ltd	Envestra Limited operates natural gas distribution networks and transmission pipelines in South Australia, Queensland and the Northern Territory. The Company's networks distribute gas to households and businesses in Adelaide, Brisbane (north of Brisbane River), Alice Springs and various regional centres in South Australia and Queensland.	S&P and Bloomberg
WestNet WA Infrastructure Holdings Pty Ltd	WestNet WA Infrastructure Holdings Pty Ltd is a natural gas distribution and gas retail company in Western Australia. The Company delivers natural gas to households in Western Australia through its network of pipelines.	Bloomberg
Pacific Hydro Pty Ltd	Pacific Hydro Pty Ltd. owns, builds and operates renewable energy power stations. The Company generates and sells electricity through its hydro-electric generating plants. Pacific Hydro has locations in Australia-Pacific, Chile and Brazil.	Bloomberg
Energy World Corp Ltd	Energy World Corporation Ltd. generates electricity. The Company operates gas-fired power plants in Sengkang, South Sulawesi, Indonesia; and Alice Springs, Northern Territory, Australia. Energy World also produces natural gas and liquefied natural gas in Australia.	Bloomberg
Tandou Ltd	Tandou Limited is an agribusiness and water investment company. The Company owns and operates large scale irrigated cropping, horticultural and pastoral operations. Tandou has invested in water entitlements.	Bloomberg
Pacific Energy Ltd	Pacific Energy Limited is involved in the investment of power generation, infrastructure and mineral projects.	Bloomberg
Carnegie Wave Energy Ltd	Carnegie Wave Energy Ltd. develops and commercializes clean energy technologies. The Company's wave technology generates renewable power from the waves in the ocean and can also be used to produce zero-emission desalinated water.	Bloomberg
Australian Power and Gas co	Australian Power and Gas Company Limited is a retail energy provider. The Company buys energy from the traded market at wholesale rates, pays network companies to deliver it and bills it's customers at retail rates.	Bloomberg
Greenbox Group Ltd	GreenBox Group Ltd. is an electricity retailer with operations focused in New South Wales. The Company retails and distributes electricity from green power energy sources such as wind, hydro, solar, and biogas.	Bloomberg
Arrow Energy Ltd	Arrow Energy Ltd. is an oil and gas exploration company with exploration activities in Australia.	Bloomberg
Wasabi Energy Ltd	Wasabi Energy Ltd. invests in energy producing companies. The Company holds investments in companies that generate electricity from waste heat and geothermal sources; manufacture biodiesel; and explores for uranium. Wasabi also has an interest in companies that offers solutions for conserving and enhancing water in Australia.	Bloomberg
Australian Energy Ltd	Australian Energy Limited is an independent electricity retailer in Australia. The Group sells electricity to residential and small and medium sized businesses in Victoria.	Bloomberg
Eastern Star Gas Ltd	Eastern Star Gas Limited explores for natural gas in Australia. The Company holds licence to explore for coal bed methane in Victoria and New South Wales.	Bloomberg
Geodynamics Ltd	Geodynamics Limited is a renewable energy producer in Australia. The Company develops emissions free, base load electricity from known Hot Dry Rock geothermal resources whereby heat is extracted by circulating water and is converted to electricity using geothermal power plants. The Company also has the rights to the Kalina Cycle Technology, a patented geothermal technology.	Bloomberg

Green Rock Energy Ltd	Green Rock Energy Limited explores for geothermal energy resources and develops low-emission, base load, renewable energy. The Company operates in parts of Australia and Hungary.	Bloomberg
Petratherm Ltd	Petratherm Limited explores for sources of geothermal energy in the South Australian region such as hot rocks. These sources can be used for the development of renewable energy power generation.	Bloomberg
Viridis Clean Energy	Viridis Clean Energy is an energy infrastructure fund which invests in a diversified global portfolio of clean energy assets. The Company's investment focus include assets that generate electricity or other consumable energy produced from renewable, waste or inherently low emission energy sources, including wind, hydro, biomass, geothermal, solar, waste fuel, natural gas.	Bloomberg
AGL Energy Ltd	AGL Energy Limited sells and distributes gas and electricity. The Company retails and wholesales energy and fuel products to customers throughout Australia.	S&P and Bloomberg
Redbank Energy Ltd	Redbank Energy Ltd is an energy company with interests in power station assets. The Company owns the Redbank Power Station, a coal fired base load power station located in Singleton, New South Wales.	Bloomberg
Eden Energy Ltd	Eden Energy Ltd. produces energy. The Company produces, uses and stores hythane, which is a mixture of hydrogen and natural gas, owns interests in coal bed methane projects and geothermal projects, and holds petroleum exploration licenses.	Bloomberg
Geothermal Resources Ltd	Geothermal Resources Ltd. develops geothermal energy projects in South Australia.	Bloomberg
Torrens Energy Ltd	Torrens Energy Limited is a Hot Fractured Rock geothermal exploration company. The Company is focused on the exploration and production of geothermal resources for power generation.	Bloomberg
Panax Geothermal Ltd	Panax Geothermal Limited explores for and produces geothermal assets. The Company mines for geothermal assets in Australia, India, and Kyrgyzstan.	Bloomberg
WHL Energy Ltd	WHL Energy Ltd. is an emerging oil and gas exploration company focused on the East African region.	Bloomberg
Kuth Energy Ltd	KUTh Energy Ltd. develops geothermal electricity generating plants in Australia.	Bloomberg
Hot Rock Ltd	Hot Rock Limited is an energy company that appraises and develops geothermal energy projects that can be developed for electricity generation within eastern Australia, North America and Europe.	Bloomberg
Energy One Ltd	Energy One Limited is a supplier of software and services to the wholesale energy and carbon markets in Australia. The Company's expertise includes the following areas: Wholesale energy and carbon trading software including front, middle and back offices; Risk management; Consulting in wholesale and retail energy markets; Retail and metering software and database services.	Bloomberg
Greenearth energy Ltd	Greenearth Energy Limited is a geothermal energy company that aims to explore for and develop geothermal resources in Australia, New Zealand and in the wider Pacific Rim.	Bloomberg
Erm power Ltd	ERM Power Ltd. generates electricity. The Company operates gas-fired power plants, and sells the electricity to large business customers.	Bloomberg
Water Resources Group Ltd	Water Resources Group Ltd. supplies potable water. The Company operates desalination plants that convert sea water to household water.	Bloomberg

Appendix C Credit Rating of BBB/BBB+ in S&P's and Moody's

Company Name	Bloomberg Ticker	Issue Date	Maturity	Amount Issued (millions)	Moody's Credit Rating	S&P Credit Rating
New Terminal Financing Co Pty Ltd	EI207347 Corp	9/04/2010	15/09/2015	285	Baa2	BBB
New Terminal Financing Co Pty Ltd	EF641349 Corp	23/08/2006	20/09/2016	165	Baa2	BBB
New Terminal Financing Co Pty Ltd	EF641357 Corp	23/08/2006	20/09/2016	100	Baa2	BBB
APT Pipelines Ltd	EI325336 Corp	22/07/2010	22/07/2020	300	Baa2	BBB
Brisbane Airport Corp Pty Ltd	EF506908 Corp	29/06/2006	1/07/2016	400	Baa2	BBB
Brisbane Airport Corp Pty Ltd	EI620440 Corp	4/04/2011	9/07/2019	200	Baa2	BBB
Rural Bank Ltd/Australia	EI199536 Corp	26/06/2008	26/06/2018	20	#N/A	BBB+
Bendigo and Adelaide Bank Ltd	EI182144 Corp	13/01/2010	13/01/2020	20	#N/A	BBB+
Bendigo and Adelaide Bank Ltd	EI514392 Corp	15/12/2010	15/12/2020	250	A3	BBB+
DBCT Finance Pty Ltd	EF461902 Corp	9/06/2006	9/06/2016	200	Baa2	BBB+
DBCT Finance Pty Ltd	EF461870 Corp	9/06/2006	9/06/2016	150	Baa2	BBB+
DBCT Finance Pty Ltd	EF462422 Corp	9/06/2006	9/06/2021	230	Baa2	BBB+
DBCT Finance Pty Ltd	EG022210 Corp	12/12/2006	12/12/2022	200	Baa2	BBB+
DBCT Finance Pty Ltd	EF462446 Corp	9/06/2006	9/06/2026	100	Baa2	BBB+
Bank of Queensland Ltd	EH390785 Corp	4/06/2008	4/06/2018	30	Baa2	BBB
Bank of Queensland Ltd	EH390789 Corp	4/06/2008	4/06/2018	140	Baa2	BBB
Bank of Queensland Ltd	EI666670 Corp	10/05/2011	10/05/2021	200	Baa2	BBB
Bank of Queensland Ltd	EI914693 Corp	22/12/2011	22/03/2022	50	Baa2	BBB
Colonial Holding Co Ltd	EJ042501 Corp	29/03/2012	31/03/2037	1000	#N/A	BBB+
CLP Australia Finance Pty Ltd	EF169465 Corp	16/11/2005	16/11/2015	50	#N/A	BBB
Caltex Australia Ltd	EI883417 Corp	23/11/2011	23/11/2018	150	#N/A	BBB+
Crown Group Finance Ltd	EJ279790 Corp	18/07/2012	18/07/2017	300	Baa2	BBB
United Energy Distribution Pty Ltd	EJ118108 Corp	11/04/2012	11/04/2017	265	Baa2	BBB
DEXUS Finance Pty Ltd	EI223256 Corp	21/04/2010	21/04/2017	210	Baa1	BBB+
DEXUS Finance Pty Ltd	EJ347760 Corp	10/09/2012	10/09/2018	150	Baa1	BBB+
Goodman Australia Industrial Fund	EI675822 Corp	19/05/2011	19/05/2016	175	#N/A	BBB
Heritage Bank Ltd	EG938481 Corp	18/10/2007	18/10/2017	10	Baa1	NR
Heritage Bank Ltd	EI023851 Corp	26/10/2009	25/10/2019	50	(P)Baa1	NR
Holcim Finance Australia Pty Ltd	EJ096330 Corp	27/03/2012	27/03/2015	250	Baa2	BBB
Holcim Finance Australia Pty Ltd	EJ278064 Corp	18/07/2012	18/07/2017	250	Baa2	BBB
Holcim Finance Australia Pty	EJ379309	4/10/2012	4/04/2019	200	Baa2	BBB

Ltd	Corp					
Investa Office Fund	EJ422500 Corp	7/11/2012	7/11/2017	125	#N/A	BBB+
Broadcast Australia Finance Pty Ltd	EJ389500 Corp	9/07/2007	9/07/2019	450	Baa2	BBB
Mirvac Group Funding Ltd	EI195249 Corp	26/03/2010	15/03/2015	200	#N/A	BBB
Mirvac Group Finance Ltd	EI414696 Corp	29/09/2010	16/09/2016	225	#N/A	BBB
National Capital Trust III	EF690677 Corp	18/09/2006	#N/A	400	Baa1	BBB+
National Australia Bank Ltd	EC170804 Corp	29/06/1999	#N/A	2000	Baa1	#N/A
Santos Finance Ltd	EF102609 Corp	23/09/2005	23/09/2015	100	#N/A	BBB+
Sydney Airport Finance Co Pty Ltd	EI308853 Corp	6/07/2010	6/07/2015	175	Baa2	BBB
Sydney Airport Finance Co Pty Ltd	ED604947 Corp	10/09/2004	20/11/2015	300	Baa2	BBB
Sydney Airport Finance Co Pty Ltd	EI684902 Corp	25/05/2011	6/07/2018	100	Baa2	BBB
Sydney Airport Finance Co Pty Ltd	ED615909 Corp	20/09/2004	20/11/2020	535	Baa2	BBB
Sydney Airport Finance Co Pty Ltd	EG064076 Corp	8/12/2006	20/11/2021	200	Baa2	BBB
Sydney Airport Finance Co Pty Ltd	EG021985 Corp	15/12/2006	11/10/2022	750	Baa2	BBB
Sydney Airport Finance Co Pty Ltd	EG021973 Corp	15/12/2006	20/11/2030	300	Baa2	BBB
Transurban Finance Co Pty Ltd	EF069537 Corp	10/11/2005	10/11/2015	300	Baa1	A-
Transurban Finance Co Pty Ltd	EI697455 Corp	8/06/2011	8/06/2016	200	Baa1	A-
Transurban Finance Co Pty Ltd	EF069549 Corp	10/11/2005	10/11/2017	300	Baa1	A-
Western Liberty Group Finance Pty Ltd	EF672441 Corp	6/09/2006	15/06/2018	27	Baa2	#N/A
Western Liberty Group Finance Pty Ltd	EF672385 Corp	6/09/2006	15/06/2020	76	Baa2	#N/A
Western Liberty Group Finance Pty Ltd	EF672469 Corp	6/09/2006	15/06/2031	110	Baa2	#N/A

The benchmark sample was constructed using the following criteria on 3 Dec 2012:

Maturity: Greater than 2 years
Currency: AUD
Country: Australia
Redemption: Bullet, Callable, Putable
Credit Ratings: S&P:BBB,BBB+; Moody's: Baa2, Baa1

Moody's credit ratings are now included in the benchmark sample. This addition is not available under the current version of the bond-yield approach in which only credit ratings by S&P are recognised. The Moody's credit ratings of Baa2 and Baa1 correspond to the S&P credit ratings of BBB and BBB+, respectively. This has resulted in an additional 9 bonds being added to the sample. Bonds highlighted in grey represent added entries due to the lack of an S&P credit rating, whilst bonds highlighted in blue represent an S&P credit rating that is above the BBB/BBB+ range; but inclusive in the Moody's Baa2/Baa1 range.

Appendix D The "NPV = 0" Principle

1. In a regulated environment in which output prices are set or capped, the present value of the revenue earned from an asset must be equal to the initial investment to ensure that the total costs incurred are recovered. If no more than or no less than the total costs are recovered, in discounted terms, then the net present value is zero (NPV=0).

2. It is argued that setting the terms of the proxies for the risk free rate and the cost of debt to match the regulatory control period – which is generally five years in Australia and New Zealand – will satisfy the NPV=0 principle. This view is supported by a range of studies, each of which is summarised briefly in what follows.

3. First, under the assumption that future interest rates are the only source of uncertainty and that the company is financed entirely by equity, Marshal et al. (1981) concluded that the period associated with the risk-free rate should match the regulatory period. These authors argued that if this principle is not satisfied, then equity holders are either over or under compensated by the regulator.

4. Schmalensee (1989)[84] and Lally (2012)[85] also assumed that there is no debt and no source of risk other than the uncertainty of the future risk free interest rates. The authors concluded that the term of the risk free rate and the term of the debt margin should be matched with the regulatory control period to ensure that equity holders are not under- or over-compensated.

5. Lally (2004) relaxed the above assumptions by considering cost and demand shocks, and risks arising from depreciation methods in which the aggregate depreciation allowed by the regulator may diverge from the cost of the assets. However, in this study, Lally continued to make the same assumption that the firm is to be totally financed by equity. The author concluded that if the risk-free rate is revised at the end of each regulatory cycle, in accordance with the prevailing rate, then the appropriate rate should be that matching the regulatory period.[86]

6. Lally (2007) continued relaxing the previous assumptions by considering the implications of issuing corporate debt. The purpose of this study was to consider the implications of the regulated firm being at least partly debt financed, as well as the possibility of the firm choosing a duration for this debt finance that diverges from the length of the regulatory cycle. Lally concluded that the NPV = 0 principle is only satisfied on the following two conditions: (i) the terms of the risk free rate and the debt risk premium must be set equal to the regulatory control period; AND (ii) the regulated businesses choose their borrowing to match the regulatory cycle. Lally also concluded that departure from either of these conditions will lead to violations of the NPV = 0 principle.[87]

7. Lally agreed that these findings do not consider any refinancing risk – the risk arising due to the exposure to unusual conditions in the debt markets at the time the debt needs to be refinanced. In response to this potential problem, Lally argued that a company may seek to stagger the roll-over of the debt in such a way that the same

[84] Schmalensee R., 1989, "An Expository Note on Depreciation and Profitability Under Rate-of-Return Regulation", *Journal of Regulatory Economics*, Volume 1, No.3, pp. 293-298.

[85] Lally M. 2012, *The Cost of Equity and The Market Risk Premium*, July, p.28.

[86] Lally M. 2004, "Regulation and the Choice of the Risk Free Rate", *Accounting Research Journal*, Volume 17, No. 1, 2004, pp. 18-23.

[87] Lally M. 2007, "Regulation and the Term of the Risk Free Rate: Implications of Corporate Debt", *Accounting Research Journal*, Volume 20, No. 2, 2007, pp. 73–80.

proportion – which is relatively small – is to be refinanced each year. Lally argued that the company's actual schedule of debt can be converted into the schedule that aligns with the regulatory control period using swap contracts available in the market (interest rate swaps would be used to deal with the risk free rate of return component and credit default swaps would deal with the debt premium).

8. More recently, Lally (2010) has argued that where the average debt term used by regulated businesses materially exceeds five years (that is, the term of the regulatory cycle), and where these firms use neither interest rate swaps nor credit default swaps to convert the longer term (say 10-year) debt into the five year debt, then the "NPV = 0" principle would be violated. This is because the allowed costs would diverge from those actually incurred by the firms.[88]

[88] Lally M. 2010, *The Appropriate Term for the Risk Free Rate and the Debt Margin,* April, p.14.